Upper Owyhee Watershed

Subbasin Assessment and

Total Maximum Daily Load

Technical Appendices

January 2003

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Glossary

305(b)	Refers to section 305 subsection "b" of the Clean Water Act. 305(b) generally describes a report of each state's water quality, and is the principle means by which the U.S. Environmental Protection Agency, congress, and the public evaluate whether U.S. waters meet water quality standards, the progress made in maintaining and restoring water quality, and the extent of the remaining problems.
303(d)	Refers to section 303 subsection "d" of the Clean Water Act. 303(d) requires states to develop a list of water bodies that do not meet water quality standards. This section also requires total maximum daily loads (TMDLs) be prepared for listed waters. Both the list and the TMDLs are subject to U.S. Environmental Protection Agency approval.
Acre-Foot	A volume of water that would cover an acre to a depth of one foot. Often used to quantify reservoir storage and the annual discharge of large rivers.
Adsorption	The adhesion of one substance to the surface of another. Clays, for example, can adsorb phosphorus and organic molecules.
Aeration	A process by which water becomes charged with air directly from the atmosphere. Dissolved gases, such as oxygen, are then available for reactions in water.
Aerobic	Describes life, processes, or conditions that require the presence of oxygen.
Assessment Database (ADB)	The ADB is a relational database application designed for the U.S. Environmental Protection Agency for tracking water quality assessment data, such as use attainment and causes and sources of impairment. States need to track this information and many other types of assessment data for thousands of water bodies, and integrate it into meaningful reports. The ADB is designed to make this process accurate, straightforward, and user-friendly for participating states, territories, tribes, and basin commissions.
Adfluvial	Describes fish whose life history involves seasonal migration from lakes to streams for spawning.

Adjunct	In the context of water quality, adjunct refers to areas directly adjacent to focal or refuge habitats that have been degraded by human or natural disturbances and do not presently support high diversity or abundance of native species.
Alevin	A newly hatched, incompletely developed fish (usually a salmonid) still in nest or inactive on the bottom of a water body, living off stored yolk.
Algae	Non-vascular (without water-conducting tissue) aquatic plants that occur as single cells, colonies, or filaments.
Alluvium	Unconsolidated recent stream deposition.
Ambient	General conditions in the environment. In the context of water quality, ambient waters are those representative of general conditions, not associated with episodic perturbations, or specific disturbances such as a wastewater outfall (Armantrout 1998, EPA 1996).
Anadromous	Fish, such as salmon and sea-run trout, that live part or the majority of their lives in the salt water but return to fresh water to spawn.
Anaerobic	Describes the processes that occur in the absence of molecular oxygen and describes the condition of water that is devoid of molecular oxygen.
Anoxia	The condition of oxygen absence or deficiency.
Anthropogenic	Relating to, or resulting from, the influence of human beings on nature.
Anti-Degradation	Refers to the U.S. Environmental Protection Agency's interpretation of the Clean Water Act goal that states and tribes maintain, as well as restore, water quality. This applies to waters that meet or are of higher water quality than required by state standards. State rules provide that the quality of those high quality waters may be lowered only to allow important social or economic development and only after adequate public participation (IDAPA 58.01.02.051). In all cases, the existing beneficial uses must be maintained. State rules further define lowered water quality to be 1) a measurable change, 2) a change adverse to a use, and 3) a change in a pollutant relevant to the water's uses (IDAPA 58.01.02.003.56).

Aquatic   Occurring, growing, or living in water.

Aquifer   An underground, water-bearing layer or stratum of permeable rock, sand, or gravel capable of yielding of water to wells or springs.

Assemblage (aquatic)   An association of interacting populations of organisms in a given water body; for example, a fish assemblage, or a benthic macroinvertebrate assemblage (also see Community) (EPA 1996).

Assimilative Capacity   The ability to process or dissipate pollutants without ill effect to beneficial uses.

Autotrophic   An organism is considered autotrophic if it uses carbon dioxide as its main source of carbon. This most commonly happens through photosynthesis.

Batholith   A large body of intrusive igneous rock that has more than 40 square miles of surface exposure and no known floor. A batholith usually consists of coarse-grained rocks such as granite.

Bedload   Material (generally sand-sized or larger sediment) that is carried along the streambed by rolling or bouncing.

Beneficial Use   Any of the various uses of water, including, but not limited to, aquatic biota, recreation, water supply, wildlife habitat, and aesthetics, which are recognized in water quality standards.

Beneficial Use Reconnaissance Program (BURP)   A program for conducting systematic biological and physical habitat surveys of water bodies in Idaho. BURP protocols address lakes, reservoirs, and wadeable streams and rivers.

Benthic   Pertaining to or living on or in the bottom sediment of a water body.

Benthic Organic Matter   The organic matter on the bottom of a water body.

Benthos   Organisms living in and on the bottom sediment of lakes and streams. Originally, the term meant the lake bottom, but it is now applied almost uniformly to the animals associated with the lake and stream bottoms.

Best Management Practices (BMPs)	Structural, nonstructural, and managerial techniques that are effective and practical means to control nonpoint source pollutants.
Best Professional Judgment	A conclusion and/or interpretation derived by a trained and/or technically competent individual by applying interpretation and synthesizing information.
Biochemical Oxygen Demand (BOD)	The amount of dissolved oxygen used by organisms during the decomposition (respiration) of organic matter, expressed as mass of oxygen per volume of water, over some specified period of time.
Biological Integrity	1) The condition of an aquatic community inhabiting unimpaired water bodies of a specified habitat as measured by an evaluation of multiple attributes of the aquatic biota (EPA 1996). 2) The ability of an aquatic ecosystem to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to the natural habitats of a region (Karr 1991).
Biomass	The weight of biological matter. Standing crop is the amount of biomass (e.g., fish or algae) in a body of water at a given time. Often expressed as grams per square meter.
Biota	The animal and plant life of a given region.
Biotic	A term applied to the living components of an area.
Clean Water Act (CWA)	The Federal Water Pollution Control Act (Public Law 92-50, commonly known as the Clean Water Act), as last reauthorized by the Water Quality Act of 1987 (Public Law 100-4), establishes a process for states to use to develop information on, and control the quality of, the nation's water resources.
Coliform Bacteria	A group of bacteria predominantly inhabiting the intestines of humans and animals but also found in soil. Coliform bacteria are commonly used as indicators of the possible presence of pathogenic organisms (also see Fecal Coliform Bacteria).
Colluvium	Material transported to a site by gravity.
Community	A group of interacting organisms living together in a given place.

Conductivity   The ability of an aqueous solution to carry electric current, expressed in micro (ì) mhos/cm at 25 °C. Conductivity is affected by dissolved solids and is used as an indirect measure of total dissolved solids in a water sample.

Cretaceous   The final period of the Mesozoic era (after the Jurassic and before the Tertiary period of the Cenozoic era), thought to have covered the span of time between 135 and 65 million years ago.

Criteria   In the context of water quality, numeric or descriptive factors taken into account in setting standards for various pollutants. These factors are used to determine limits on allowable concentration levels, and to limit the number of violations per year. EPA develops criteria guidance; states establish criteria.

Cubic Feet per Second   A unit of measure for the rate of flow or discharge of water. One cubic foot per second is the rate of flow of a stream with a cross-section of one square foot flowing at a mean velocity of one foot per second. At a steady rate, once cubic foot per second is equal to 448.8 gallons per minute and 10,984 acre-feet per day.

Cultural Eutrophication   The process of eutrophication that has been accelerated by human-caused influences. Usually seen as an increase in nutrient loading (also see Eutrophication).

Culturally Induced Erosion Erosion caused by increased runoff or wind action due to the work of humans in deforestation, cultivation of the land, overgrazing, and disturbance of natural drainages; the excess of erosion over the normal for an area (also see Erosion).

Debris Torrent   The sudden down slope movement of soil, rock, and vegetation on steep slopes, often caused by saturation from heavy rains.

Decomposition   The breakdown of organic molecules (e.g., sugar) to inorganic molecules (e.g., carbon dioxide and water) through biological and nonbiological processes.

Depth Fines   Percent by weight of particles of small size within a vertical core of volume of a streambed or lake bottom sediment. The upper size threshold for fine sediment for fisheries purposes varies from 0.8 to 6.5 mm depending on the observer and methodology used. The depth sampled varies but is typically about one foot (30 cm).

Designated Uses   Those water uses identified in state water quality standards that must be achieved and maintained as required under the Clean Water Act.

Discharge   The amount of water flowing in the stream channel at the time of measurement. Usually expressed as cubic feet per second (cfs).

Dissolved Oxygen (DO)   The oxygen dissolved in water. Adequate DO is vital to fish and other aquatic life.

Disturbance   Any event or series of events that disrupts ecosystem, community, or population structure and alters the physical environment.

E. coli   Short for *Escherichia Coli*, *E. coli* are a group of bacteria that are a subspecies of coliform bacteria. Most *E. coli* are essential to the healthy life of all warm-blooded animals, including humans. Their presence is often indicative of fecal contamination.

Ecology   The scientific study of relationships between organisms and their environment; also defined as the study of the structure and function of nature.

Ecological Indicator   A characteristic of an ecosystem that is related to, or derived from, a measure of a biotic or abiotic variable that can provide quantitative information on ecological structure and function. An indicator can contribute to a measure of integrity and sustainability. Ecological indicators are often used within the multimetric index framework.

Ecological Integrity   The condition of an unimpaired ecosystem as measured by combined chemical, physical (including habitat), and biological attributes (EPA 1996).

Ecosystem   The interacting system of a biological community and its non-living (abiotic) environmental surroundings.

Effluent   A discharge of untreated, partially treated, or treated wastewater into a receiving water body.

Endangered Species   Animals, birds, fish, plants, or other living organisms threatened with imminent extinction. Requirements for declaring a species as endangered are contained in the Endangered Species Act.

Environment   The complete range of external conditions, physical and biological, that affect a particular organism or community.

Eocene   An epoch of the early Tertiary period, after the Paleocene and before the Oligocene.

Eolian   Windblown, referring to the process of erosion, transport, and deposition of material by the wind.

Ephemeral Stream   A stream or portion of a stream that flows only in direct response to precipitation. It receives little or no water from springs and no long continued supply from melting snow or other sources. Its channel is at all times above the water table. (American Geologic Institute 1962).

Erosion   The wearing away of areas of the earth's surface by water, wind, ice, and other forces.

Eutrophic   From Greek for "well nourished," this describes a highly productive body of water in which nutrients do not limit algal growth. It is typified by high algal densities and low clarity.

Eutrophication   1) Natural process of maturing (aging) in a body of water. 2) The natural and human-influenced process of enrichment with nutrients, especially nitrogen and phosphorus, leading to an increased production of organic matter.

Exceedence   A violation (according to DEQ policy) of the pollutant levels permitted by water quality criteria.

Existing Beneficial Use or Existing Use   A beneficial use actually attained in waters on or after November 28, 1975, whether or not the use is designated for the waters in Idaho's *Water Quality Standards and Wastewater Treatment Requirements* (IDAPA 58.01.02).

Exotic Species   A species that is not native (indigenous) to a region.

Extrapolation   Estimation of unknown values by extending or projecting from known values.

Fauna	Animal life, especially the animals characteristic of a region, period, or special environment.
Fecal Coliform Bacteria	Bacteria found in the intestinal tracts of all warm-blooded animals or mammals. Their presence in water is an indicator of pollution and possible contamination by bacteria (also see Coliform Bacteria).
Fecal Streptococci	A species of spherical bacteria including pathogenic strains found in the intestines of warm-blooded animals.
Feedback Loop	In the context of watershed management planning, a feedback loop is a process that provides for tracking progress toward goals and revising actions according to that progress.
Fixed-Location Monitoring	Sampling or measuring environmental conditions continuously or repeatedly at the same location.
Flow	See Discharge.
Fluvial	In fisheries, this describes fish whose life history takes place entirely in streams but migrate to smaller streams for spawning.
Focal	Critical areas supporting a mosaic of high quality habitats that sustain a diverse or unusually productive complement of native species.
Fully Supporting	In compliance with water quality standards and within the range of biological reference conditions for all designated and exiting beneficial uses as determined through the *Water Body Assessment Guidance* (Grafe et al. 2000).
Fully Supporting Cold Water	Reliable data indicate functioning, sustainable cold water biological assemblages (e.g., fish, macroinvertebrates, or algae), none of which have been modified significantly beyond the natural range of reference conditions (EPA 1997).
Fully Supporting but Threatened	An intermediate assessment category describing water bodies that fully support beneficial uses, but have a declining trend in water quality conditions, which if not addressed, will lead to a "not fully supporting" status.
Geographical Information Systems (GIS)	A georeferenced database.

Geometric Mean   A back-transformed mean of the logarithmically transformed numbers often used to describe highly variable, right-skewed data (a few large values), such as bacterial data.

Grab Sample   A single sample collected at a particular time and place. It may represent the composition of the water in that water column.

Gradient   The slope of the land, water, or streambed surface.

Ground Water   Water found beneath the soil surface saturating the layer in which it is located. Most ground water originates as rainfall, is free to move under the influence of gravity, and usually emerges again as stream flow.

Growth Rate   A measure of how quickly something living will develop and grow, such as the amount of new plant or animal tissue produced per a given unit of time, or number of individuals added to a population.

Habitat   The living place of an organism or community.

Headwater   The origin or beginning of a stream.

Hydrologic Basin   The area of land drained by a river system, a reach of a river and its tributaries in that reach, a closed basin, or a group of streams forming a drainage area (also see Watershed).

Hydrologic Cycle   The cycling of water from the atmosphere to the earth (precipitation) and back to the atmosphere (evaporation and plant transpiration). Atmospheric moisture, clouds, rainfall, runoff, surface water, ground water, and water infiltrated in soils are all part of the hydrologic cycle.

Hydrologic Unit   One of a nested series of numbered and named watersheds arising from a national standardization of watershed delineation. The initial 1974 effort (USGS 1987) described four levels (region, subregion, accounting unit, cataloging unit) of watersheds throughout the United States. The fourth level is uniquely identified by an eight-digit code built of two-digit fields for each level in the classification. Originally termed a cataloging unit, fourth field hydrologic units have been more commonly called subbasins. Fifth and sixth field hydrologic units have since been delineated for much of the country and are known as watershed and subwatersheds, respectively.

Hydrologic Unit Code (HUC)   The number assigned to a hydrologic unit. Often used to refer to fourth field hydrologic units.

Hydrology   The science dealing with the properties, distribution, and circulation of water.

Impervious   Describes a surface, such as pavement, that water cannot penetrate.

Influent   A tributary stream.

Inorganic   Materials not derived from biological sources.

Instantaneous   A condition or measurement at a moment (instant) in time.

Intergravel Dissolved Oxygen   The concentration of dissolved oxygen within spawning gravel. Consideration for determining spawning gravel includes species, water depth, velocity, and substrate.

Intermittent Stream   1) A stream that flows only part of the year, such as when the ground water table is high or when the stream receives water from springs or from surface sources such as melting snow in mountainous areas. The stream ceases to flow above the streambed when losses from evaporation or seepage exceed the available stream flow. 2) A stream that has a period of zero flow for at least one week during most years.

Interstate Waters   Waters that flow across or form part of state or international boundaries, including boundaries with Indian nations.

Irrigation Return Flow   Surface (and subsurface) water that leaves a field following the application of irrigation water and eventually flows into streams.

Key Watershed   A watershed that has been designated in Idaho Governor Batt's *State of Idaho Bull Trout Conservation Plan* (1996) as critical to the long-term persistence of regionally important trout populations.

Knickpoint   Any interruption or break of slope.

Land Application   A process or activity involving application of wastewater, surface water, or semi-liquid material to the land surface for the purpose of treatment, pollutant removal, or ground water recharge.

Limiting Factor   A chemical or physical condition that determines the growth potential of an organism. This can result in a complete inhibition of growth, but typically results in less than maximum growth rates.

Limnology   The scientific study of fresh water, especially the history, geology, biology, physics, and chemistry of lakes.

Load Allocation (LA)   A portion of a water body's load capacity for a given pollutant that is given to a particular nonpoint source (by class, type, or geographic area).

Load(ing)   The quantity of a substance entering a receiving stream, usually expressed in pounds or kilograms per day or tons per year. Loading is the product of flow (discharge) and concentration.

Loading Capacity (load capacity)   A determination of how much pollutant a water body can receive over a given period without causing violations of state water quality standards. Upon allocation to various sources, and a margin of safety, it becomes a total maximum daily load.

Loam   Refers to a soil with a texture resulting from a relative balance of sand, silt, and clay. This balance imparts many desirable characteristics for agricultural use.

Loess   A uniform wind-blown deposit of silty material. Silty soils are among the most highly erodable.

Lotic   An aquatic system with flowing water such as a brook, stream, or river where the net flow of water is from the headwaters to the mouth.

Luxury Consumption   A phenomenon in which sufficient nutrients are available in either the sediment or the water column of a water body, such that aquatic plants take up and store an abundance in excess of the plants' current needs.

Macroinvertebrate   An invertebrate animal (without a backbone) large enough to be seen without magnification and retained by a 500ìm mesh (U.S. #30) screen.

Macrophytes   Rooted and floating vascular aquatic plants, commonly referred to as water weeds. These plants usually flower and bear seeds. Some forms, such as duckweed and coontail (*Ceratophyllum sp.*), are free-floating forms not rooted in sediment.

Margin of Safety (MOS)   An implicit or explicit portion of a water body's loading capacity set aside to allow the uncertainly about the relationship between the pollutant loads and the quality of the receiving water body. This is a required component of a total maximum daily load (TMDL) and is often incorporated into conservative assumptions used to develop the TMDL (generally within the calculations and/or models). The MOS is not allocated to any sources of pollution.

Mass Wasting   A general term for the down slope movement of soil and rock material under the direct influence of gravity.

Mean   Describes the central tendency of a set of numbers. The arithmetic mean (calculated by adding all items in a list, then dividing by the number of items) is the statistic most familiar to most people.

Median   The middle number in a sequence of numbers. If there are an even number of numbers, the median is the average of the two middle numbers. For example, 4 is the median of 1, 2, 4, 14, 16; and 6 is the median of 1, 2, 5, 7, 9, 11.

Metric   1) A discrete measure of something, such as an ecological indicator (e.g., number of distinct taxon). 2) The metric system of measurement.

Milligrams per Liter (mg/l)   A unit of measure for concentration in water, essentially equivalent to parts per million (ppm).

Million gallons per day (MGD)   A unit of measure for the rate of discharge of water, often used to measure flow at wastewater treatment plants. One MGD is equal to 1.547 cubic feet per second.

Miocene   Of, relating to, or being an epoch of, the Tertiary between the Pliocene and the Oligocene periods, or the corresponding system of rocks.

Monitoring   A periodic or continuous measurement of the properties or conditions of some medium of interest, such as monitoring a water body.

Mouth   The location where flowing water enters into a larger water body.

National Pollution Discharge Elimination System (NPDES)	A national program established by the Clean Water Act for permitting point sources of pollution. Discharge of pollution from point sources is not allowed without a permit.
Natural Condition	A condition indistinguishable from that without human-caused disruptions.
Nitrogen	An element essential to plant growth, and thus is considered a nutrient.
Nodal	Areas that are separated from focal and adjunct habitats, but serve critical life history functions for individual native fish.
Nonpoint Source	A dispersed source of pollutants, generated from a geographical area when pollutants are dissolved or suspended in runoff and then delivered into waters of the state. Nonpoint sources are without a discernable point or origin. They include, but are not limited to, irrigated and non-irrigated lands used for grazing, crop production, and silviculture; rural roads; construction and mining sites; log storage or rafting; and recreation sites.
Not Assessed (NA)	A concept and an assessment category describing water bodies that have been studied, but are missing critical information needed to complete an assessment.
Not Attainable	A concept and an assessment category describing water bodies that demonstrate characteristics that make it unlikely that a beneficial use can be attained (e.g., a stream that is dry but designated for salmonid spawning).
Not Fully Supporting	Not in compliance with water quality standards or not within the range of biological reference conditions for any beneficial use as determined through the *Water Body Assessment Guidance* (Grafe et al. 2000).
Not Fully Supporting Cold Water	At least one biological assemblage has been significantly modified beyond the natural range of its reference condition (EPA 1997).
Nuisance	Anything which is injurious to the public health or an obstruction to the free use, in the customary manner, of any waters of the state.

Nutrient   Any substance required by living things to grow. An element or its chemical forms essential to life, such as carbon, oxygen, nitrogen, and phosphorus. Commonly refers to those elements in short supply, such as nitrogen and phosphorus, which usually limit growth.

Nutrient Cycling   The flow of nutrients from one component of an ecosystem to another, as when macrophytes die and release nutrients that become available to algae (organic to inorganic phase and return).

Oligotrophic   The Greek term for "poorly nourished." This describes a body of water in which productivity is low and nutrients are limiting to algal growth, as typified by low algal density and high clarity.

Organic Matter   Compounds manufactured by plants and animals that contain principally carbon.

Orthophosphate   A form of soluble inorganic phosphorus most readily used for algal growth.

Oxygen-Demanding Materials   Those materials, mainly organic matter, in a water body which consume oxygen during decomposition.

Parameter   A variable, measurable property whose value is a determinant of the characteristics of a system; e.g., temperature, dissolved oxygen, and fish populations are parameters of a stream or lake.

Partitioning   The sharing of limited resources by different races or species; use of different parts of the habitat, or the same habitat at different times. Also the separation of a chemical into two or more phases, such as partitioning of phosphorus between the water column and sediment.

Bacteria   Disease-producing organisms (e.g., bacteria, viruses, parasites).

Perennial Stream   A stream that flows year-around in most years.

Periphyton   Attached microflora (algae and diatoms) growing on the bottom of a water body or on submerged substrates, including larger plants.

Pesticide   Substances or mixtures of substances intended for preventing, destroying, repelling, or mitigating any pest. Also, any substance or mixture intended for use as a plant regulator, defoliant, or desiccant.

pH   The negative $\log_{10}$ of the concentration of hydrogen ions, a measure which in water ranges from very acid (pH=1) to very alkaline (pH=14). A pH of 7 is neutral. Surface waters usually measure between pH 6 and 9.

Phased TMDL   A total maximum daily load (TMDL) that identifies interim load allocations and details further monitoring to gauge the success of management actions in achieving load reduction goals and the effect of actual load reductions on the water quality of a water body. Under a phased TMDL, a refinement of load allocations, wasteload allocations, and the margin of safety is planned at the outset.

Phosphorus   An element essential to plant growth, often in limited supply, and thus considered a nutrient.

Physiochemical   In the context of bioassessment, the term is commonly used to mean the physical and chemical factors of the water column that relate to aquatic biota. Examples in bioassessment usage include saturation of dissolved gases, temperature, pH, conductivity, dissolved or suspended solids, forms of nitrogen, and phosphorus. This term is used interchangeable with the terms "physical/chemical" and "physicochemical."

Plankton   Microscopic algae (phytoplankton) and animals (zooplankton) that float freely in open water of lakes and oceans.

Point Source   A source of pollutants characterized by having a discrete conveyance, such as a pipe, ditch, or other identifiable "point" of discharge into a receiving water. Common point sources of pollution are industrial and municipal wastewater.

Pollutant   Generally, any substance introduced into the environment that adversely affects the usefulness of a resource or the health of humans, animals, or ecosystems.

Pollution

A very broad concept that encompasses human-caused changes in the environment which alter the functioning of natural processes and produce undesirable environmental and health effects. This includes human-induced alteration of the physical, biological, chemical, and radiological integrity of water and other media.

Population

A group of interbreeding organisms occupying a particular space; the number of humans or other living creatures in a designated area.

Pretreatment

The reduction in the amount of pollutants, elimination of certain pollutants, or alteration of the nature of pollutant properties in wastewater prior to, or in lieu of, discharging or otherwise introducing such wastewater into a publicly owned wastewater treatment plant.

Primary Productivity

The rate at which algae and macrophytes fix carbon dioxide using light energy. Commonly measured as milligrams of carbon per square meter per hour.

Protocol

A series of formal steps for conducting a test or survey.

Qualitative

Descriptive of kind, type, or direction.

Quality Assurance (QA)

A program organized and designed to provide accurate and precise results. Included are the selection of proper technical methods, tests, or laboratory procedures; sample collection and preservation; the selection of limits; data evaluation; quality control; and personnel qualifications and training. The goal of QA is to assure the data provided are of the quality needed and claimed (Rand 1995, EPA 1996).

Quality Control (QC)

Routine application of specific actions required to provide information for the quality assurance program. Included are standardization, calibration, and replicate samples. QC is implemented at the field or bench level (Rand 1995, EPA 1996).

Quantitative

Descriptive of size, magnitude, or degree.

Reach

A stream section with fairly homogenous physical characteristics.

Reconnaissance

An exploratory or preliminary survey of an area.

Reference

A physical or chemical quantity whose value is known, and thus is used to calibrate or standardize instruments.

Reference Condition   1) A condition that fully supports applicable beneficial uses with little affect from human activity and represents the highest level of support attainable. 2) A benchmark for populations of aquatic ecosystems used to describe desired conditions in a biological assessment and acceptable or unacceptable departures from them. The reference condition can be determined through examining regional reference sites, historical conditions, quantitative models, and expert judgment (Hughes 1995).

Reference Site   A specific locality on a water body that is minimally impaired and is representative of reference conditions for similar water bodies.

Representative Sample   A portion of material or water that is as similar in content and consistency as possible to that in the larger body of material or water being sampled.

Resident   A term that describes fish that do not migrate.

Respiration   A process by which organic matter is oxidized by organisms, including plants, animals, and bacteria. The process converts organic matter to energy, carbon dioxide, water, and lesser constituents.

Riffle   A relatively shallow, gravelly area of a streambed with a locally fast current, recognized by surface choppiness. Also an area of higher streambed gradient and roughness.

Riparian   Associated with aquatic (stream, river, lake) habitats. Living or located on the bank of a water body.

Riparian Habitat Conservation Area (RHCA)   A U.S. Forest Service description of land within the following number of feet up-slope of each of the banks of streams:
- 300 feet from perennial fish-bearing streams
- 150 feet from perennial non-fish-bearing streams
- 100 feet from intermittent streams, wetlands, and ponds
in priority watersheds.

River   A large, natural, or human-modified stream that flows in a defined course or channel, or a series of diverging and converging channels.

Runoff   The portion of rainfall, melted snow, or irrigation water that flows across the surface, through shallow underground zones (interflow), and through ground water to creates streams.

Sediment   Deposits of fragmented materials from weathered rocks and organic material that were suspended in, transported by, and eventually deposited by water or air.

Settleable Solids   The volume of material that settles out of one liter of water in one hour.

Species   1) A reproductively isolated aggregate of interbreeding organisms having common attributes and usually designated by a common name. 2) An organism belonging to such a category.

Spring   Ground water seeping out of the earth where the water table intersects the ground surface.

Stagnation   The absence of mixing in a water body.

Stenothermal   Unable to tolerate a wide temperature range.

Stratification   An Idaho Department of Environmental Quality classification method used to characterize comparable units (also called classes or strata).

Stream   A natural water course containing flowing water, at least part of the year. Together with dissolved and suspended materials, a stream normally supports communities of plants and animals within the channel and the riparian vegetation zone.

Stream Order   Hierarchical ordering of streams based on the degree of branching. A first-order stream is an unforked or unbranched stream. Under Strahler's (1957) system, higher order streams result from the joining of two streams of the same order.

Storm Water Runoff   Rainfall that quickly runs off the land after a storm. In developed watersheds the water flows off roofs and pavement into storm drains that may feed quickly and directly into the stream. The water often carries pollutants picked up from these surfaces.

Stressors   Physical, chemical, or biological entities that can induce adverse effects on ecosystems or human health.

Subbasin   A large watershed of several hundred thousand acres. This is the name commonly given to 4th field hydrologic units (also see Hydrologic Unit).

Subbasin Assessment   A watershed-based problem assessment that is the first step in

(SBA) developing a total maximum daily load in Idaho.

Subwatershed A smaller watershed area delineated within a larger watershed, often for purposes of describing and managing localized conditions. Also proposed for adoption as the formal name for 6th field hydrologic units.

Surface Fines Sediment of small size deposited on the surface of a streambed or lake bottom. The upper size threshold for fine sediment for fisheries purposes varies from 0.8 to 605 mm depending on the observer and methodology used. Results are typically expressed as a percentage of observation points with fine sediment.

Surface Runoff Precipitation, snow melt, or irrigation water in excess of what can infiltrate the soil surface and be stored in small surface depressions; a major transporter of nonpoint source pollutants in rivers, streams, and lakes. Surface runoff is also called overland flow.

Surface Water All water naturally open to the atmosphere (rivers, lakes, reservoirs, streams, impoundments, seas, estuaries, etc.) and all springs, wells, or other collectors that are directly influenced by surface water.

Suspended Sediment Fine material (usually sand size or smaller) that remains suspended by turbulence in the water column until deposited in areas of weaker current. These sediment cause turbidity and, when deposited, reduce living space within streambed gravels and can cover fish eggs or alevins.

Taxon Any formal taxonomic unit or category of organisms (e.g., species, genus, family, order). The plural of taxon is taxa (Armantrout 1998).

Tertiary An interval of geologic time lasting from 66.4 to 1.6 million years ago. It constitutes the first of two periods of the Cenozoic Era, the second being the Quaternary. The Tertiary has five subdivisions, which from oldest to youngest are the Paleocene, Eocene, Oligocene, Miocene, and Pliocene epochs.

Thalweg The center of a stream's current, where most of the water flows.

Threatened Species Species, determined by the U.S. Fish and Wildlife Service, which are likely to become endangered within the foreseeable future throughout all or a significant portion of their range.

Total Maximum Daily Load (TMDL)

A TMDL is a water body's loading capacity after it has been allocated among pollutant sources. It can be expressed on a time basis other than daily if appropriate. Sediment loads, for example, are often calculated on an annual bases. TMDL = Loading Capacity = Load Allocation + Wasteload Allocation + Margin of Safety. In common usage, a TMDL also refers to the written document that contains the statement of loads and supporting analyses, often incorporating TMDLs for several water bodies and/or pollutants within a given watershed.

Total Dissolved Solids

Dry weight of all material in solution in a water sample as determined by evaporating and drying filtrate.

Total Suspended Solids (TSS)

The dry weight of material retained on a filter after filtration. Filter pore size and drying temperature can vary. American Public Health Association Standard Methods (Greenborg, Clescevi, and Eaton 1995) call for using a filter of 2.0 micron or smaller; a 0.45 micron filter is also often used. This method calls for drying at a temperature of 103-105 °C.

Toxic Pollutants

Materials that cause death, disease, or birth defects in organisms that ingest or absorb them. The quantities and exposures necessary to cause these effects can vary widely.

Tributary

A stream feeding into a larger stream or lake.

Trophic State

The level of growth or productivity of a lake as measured by phosphorus content, chlorophyll *a* concentrations, amount (biomass) of aquatic vegetation, algal abundance, and water clarity.

Turbidity

A measure of the extent to which light passing through water is scattered by fine suspended materials. The effect of turbidity depends on the size of the particles (the finer the particles, the greater the effect per unit weight) and the color of the particles.

Vadose Zone

The unsaturated region from the soil surface to the ground water table.

Wasteload Allocation (WLA)

The portion of receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution. Wasteload allocations specify how much pollutant each point source may release to a water body.

Water Body	A stream, river, lake, estuary, coastline, or other water feature, or portion thereof.
Water Column	Water between the interface with the air at the surface and the interface with the sediment layer at the bottom. The idea derives from a vertical series of measurements (oxygen, temperature, phosphorus) used to characterize water.
Water Pollution	Any alteration of the physical, thermal, chemical, biological, or radioactive properties of any waters of the state, or the discharge of any pollutant into the waters of the state, which will or is likely to create a nuisance or to render such waters harmful, detrimental, or injurious to public health, safety, or welfare; to fish and wildlife; or to domestic, commercial, industrial, recreational, aesthetic, or other beneficial uses.
Water Quality	A term used to describe the biological, chemical, and physical characteristics of water with respect to its suitability for a beneficial use.
Water Quality Criteria	Levels of water quality expected to render a body of water suitable for its designated uses. Criteria are based on specific levels of pollutants that would make the water harmful if used for drinking, swimming, farming, or industrial processes.
Water Quality Limited	A label that describes water bodies for which one or more water quality criterion is not met or beneficial uses are not fully supported. Water quality limited segments may or may not be on a 303(d) list.
Water Quality Limited Segment (WQLS)	Any segment placed on a state's 303(d) list for failure to meet applicable water quality standards, and/or is not expected to meet applicable water quality standards in the period prior to the next list. These segments are also referred to as "303(d) listed."
Water Quality Management Plan	A state or area-wide waste treatment management plan developed and updated in accordance with the provisions of the Clean Water Act.
Water Quality Modeling	The prediction of the response of some characteristics of lake or stream water based on mathematical relations of input variables such as climate, stream flow, and inflow water quality.

Water Quality Standards   State-adopted and EPA-approved ambient standards for water bodies. The standards prescribe the use of the water body and establish the water quality criteria that must be met to protect designated uses.

Water Table   The upper surface of ground water; below this point, the soil is saturated with water.

Watershed   1) All the land which contributes runoff to a common point in a drainage network, or to a lake outlet. Watersheds are infinitely nested, and any large watershed is composed of smaller "subwatersheds." 2) The whole geographic region which contributes water to a point of interest in a water body.

Water Body Identification Number (WBID)   A number that uniquely identifies a water body in Idaho ties in to the Idaho Water Quality Standards and GIS information.

Wetland   An area that is at least some of the time saturated by surface or ground water so as to support with vegetation adapted to saturated soil conditions. Examples include swamps, bogs, fens, and marshes.

Young of the Year   Young fish born the year captured, evidence of spawning activity.

Appendix A. Unit Conversion Chart

Table A1. Metric - English unit conversions.

	English Units	Metric Units	To Convert	Example
Distance	Miles (mi.)	Kilometers (km)	1 mi. = 1.61 km 1 km = 0.62 mi.	3 mi. = 4.83 km 3 km = 1.86 mi.
Length	Inches (in) Feet (ft)	Centimeters (cm) Meters (m)	1 in = 2.54 cm 1 cm = 0.39 in 1 ft = 0.30 m 1 m = 3.28 ft	3 in = 7.62 cm 3 cm = 1.18 in 3 ft = 0.91 m 3 m = 9.84 ft
Area	Acres (ac) Square Feet (ft^2) Square Miles (mi^2)	Hectares (ha) Square Meters (m^2) Square Kilometers (km^2)	1 ac = 0.40 ha 1 ha = 2.47 ac 1 ft^2 = 0.09 m^2 1 m^2 = 10.76 ft^2 1 mi^2 = 2.59 km^2 1 km^2 = 0.39 mi^2	3 ac = 1.20 ha 3 ha = 7.41 ac 3 ft^2 = 0.28 m^2 3 m^2 = 32.29 ft^2 3 mi^2 = 7.77 km^2 3 km^2 = 1.16 mi^2
Volume	Gallons (g) Cubic Feet (ft^3)	Liters (l) Cubic Meters (m^3)	1 g = 3.78 l 1 l = 0.26 g 1 ft^3 = 0.03 m^3 1 m^3 = 35.32 ft^3	3 g = 11.35 l 3 l = 0.79 g 3 ft^3 = 0.09 m^3 3 m^3 = 105.94 ft^3
Flow Rate	Cubic Feet per Second (ft^3/sec)[1]	Cubic Meters per Second (m^3/sec)	1 ft^3/sec = 0.03 ^{3}/sec 1 m^3/sec = ft^3/sec	3 ft^3/sec = 0.09 m^3/sec 3 m^3/sec = 105.94 ft^3/sec
Concentration	Parts per Million (ppm)	Milligrams per Liter (mg/l)	1 ppm = 1 mg/l[2]	3 ppm = 3 mg/l
Weight	Pounds (lbs.)	Kilograms (kg)	1 lb. = 0.45 kg 1 kg = 2.20 lbs.	3 lb. = 1.36 kg 3 kg = 6.61 kg
Temperature	Fahrenheit (°F)	Celsius (°C)	°C = 0.55 (F - 32) °F = (C x 1.8) + 32	3 °F = -15.95 °C 3 ° C = 37.4 °F

[1] 1 ft^3/sec = 0.65 million gallons per day; 1 million gallons per day is equal to 1.55 ft^3/sec.

[2] The ratio of 1 ppm = 1 mg/l is approximate and is only accurate for water.

Appendix B. 5th Field Statistics

Table B1. 5th Field Statistics.

Upper Owyhee 4th Field HUC	Statistics
Land Use	
Rangeland	889,562 acres (88%)
Irrigated Gravity	1,493 acres (<1%)
Irrigated Sprinkler	2,396 acres (<1%)
Riparian	42,856 acres (4%)
Forested	76,108 acres (7.5%)
Ownership/Management	
Private	65,653 acres (6.5%)
State of Idaho	73,428 acres (7.3%)
Federal/Bureau of Land Management	746,833 acres (73.8%)
Federal/Tribal Lands	122,375 acres (12.1%)
Open Water	4,117 acres (0.4%)
5th Field HUCs	
Blue Creek	129,460 acres (11.8%)
Blue Creek Reservoir	136,477 acres (12.5%)
Deep Creek	71,598 acres (6.5%)
Lower Battle Creek	82,525 acres (7.5%)
Hurry Back Creek	98,405 acres (9.0%)
Lower Owyhee River	53,428 acres (4.9%)
Paiute Creek	50,634 acres (4.6%)
Pole Creek	54,550 acres (5.0%)
Red Canyon	49,898 acres (4.6%)
Ross Lake	110,009 acres (10.1%)
Dickshooter Creek	49,010 acres (4.5%)
Upper Battle Creek	100,653 acres (9.2%)
Yatahoney Creek*	107,994 acres (9.8%)
303(d) Listed Segments	
Blue Creek Reservoir	
Pollutants of Concern	Sediment
Juniper Basin Reservoir	749 acres
Pollutants of Concern	Sediment
Deep Creek	35.0 miles
Pollutants of Concern	Temperature and Sediment
Pole Creek	24.1 miles
Pollutants of Concern	Temperature and Sediment

Castle Creek	11.3 miles
Pollutants of Concern	Temperature and Sediment
Battle Creek	62.5 miles
Pollutants of Concern	Bacteria
Shoofly Creek	22.9 miles
Pollutants of Concern	Temperature and Sediment
Red Canyon Creek	5.2 miles
Pollutants of Concern	Temperature and Sediment
Nickel Creek	2.8 miles
Pollutants of Concern	Sediment

* Portions within state of Nevada

Table B2. Blue Creek 5th Field HUC Statistics.

Blue Creek 5th Field HUC	Statistics
Total Area	129,460 acres
0-1st Order Streams	92.5 miles
2nd Order Streams	50.0 miles
3rd Order Streams	14.8 miles
4th Order Streams	16.6 miles
5th Order Streams	
Canal Ditches	59.1 miles
Other	6.2 miles
§303(d) Listed Segments	
Shoofly Creek	1.6 miles
Listed Pollutant	Bacteria
Land Use	
Rangeland	94,039 acres
Irrigated	1,982 acres
Land Ownership/Management	
Private	10,320 acres
State of Idaho	14,955 acres
Federal (BLM)	11,101 acres
Open Water	535 acres
Federal (Tribal)	59,112 acres
Other Water Bodies	
Bell Creek	9.2 miles
Blue Creek	15.2 miles
Boyle Creek	4.5 miles
Damon Creek	2.6 miles
Dry Creek	7.0 miles
Indian Creek	4.8 miles
Miller Creek	6.3 miles
Moorcastle Creek	4.4 miles
Mountain View Lake	2.4 miles
Mud Creek	6.2 miles
Old Man Creek	5.2 miles
Papoose Creek	5.6 miles
Payne Creek	11.7 miles
Pig Creek	7.5 miles
Squaw Creek	16.0 miles

Blue Creek 5th Field HUC	Statistics
Thacker Slough	3.6 miles
Unnamed	117.3 miles

Blue creek hydro.shp
1
2
3
4
5
6
Ditches
EF Owyhee
No Data
Blue creek ownership.shp
B.L.M.
Bureau of Indian Affairs
Open water
Private
State of Idaho
Landuse-blue creek .shp
Forest
Irrigated-Gravity Flow
Irrigated-Sprinkler
Rangeland
Riparian
Blue creek 5th field.shp

N

1   0   1   2   Miles

Blue Creek
5th Field HUC
Landuse-Ownership
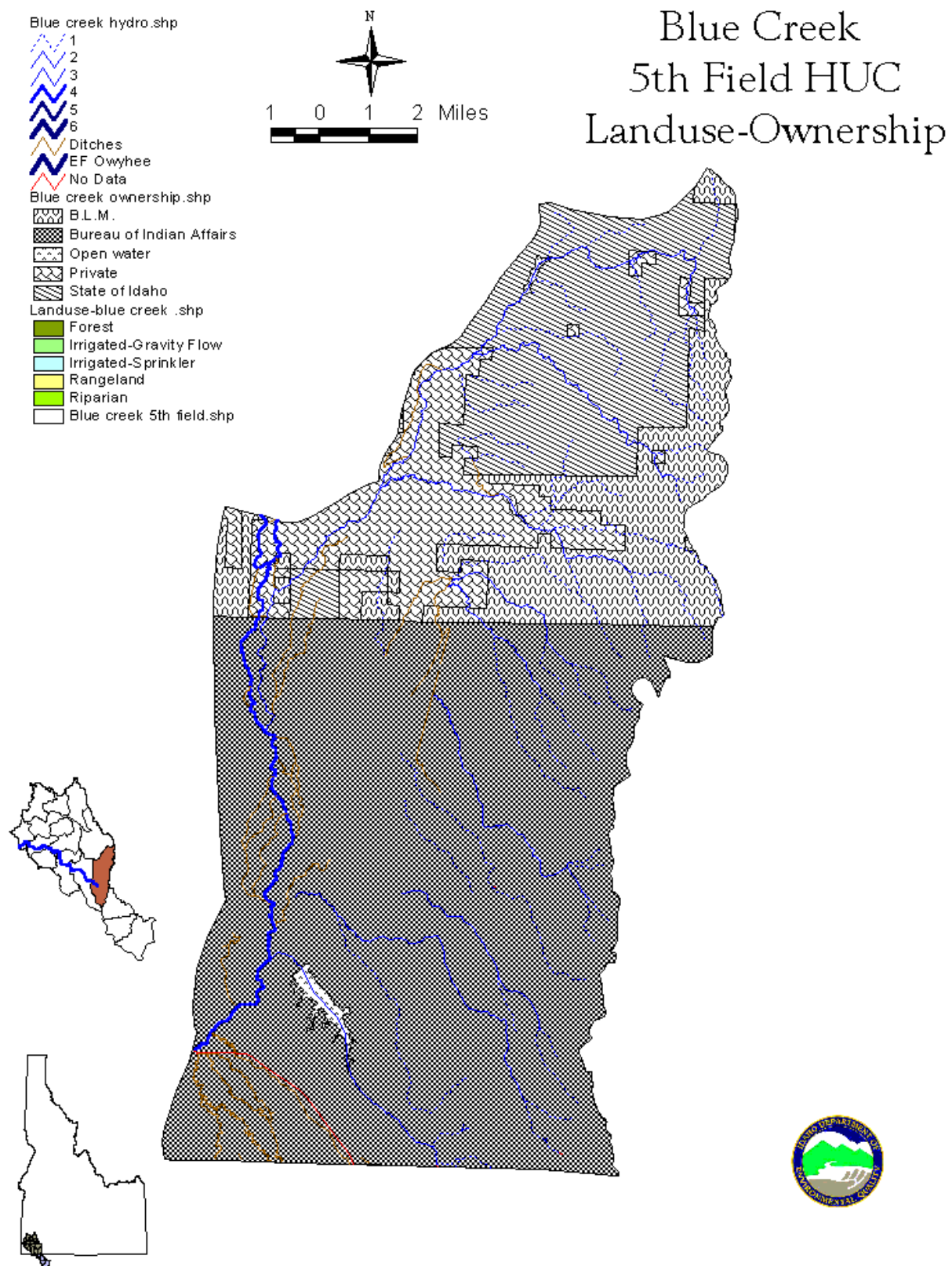
Table B3. Blue Creek Reservoir 5th Field HUC Statistics.

Blue Creek Reservoir	Statistics
5th Field HUC	
Total Area	136,477 acres
0-1st Order Streams	207.9 miles
2nd Order Streams	51.8 miles
3rd Order Streams	49.2 miles
4th Order Streams	16.5 miles
Canals/Ditches	13.4 miles
§303(d) Listed Segments	
Shoofly Creek	21.4 miles
Listed Pollutant	Bacteria
Blue Creek Reservoir	185 acres
Listed Pollutant	Sediment
Land Use	
Rangeland	136,062 acres (99%)
Irrigated	418 acres (<1%)
Land Ownership/Management	
Private	17,182 acres (12.7%)
State of Idaho	17,462 acres (12.8%)
Federal (BLM)	101,182 acres (74.1%)
Open Water	494 acres (<.1%)
Other Water Bodies	
Blue Creek	33.3 miles
Little Blue Creek	10.1 miles
Harris Creek	11.3 miles
Bybee Reservoir	
Little Blue Creek Reservoir	

Legend

Blue creek res.shp

Blue res stream order.shp
- 1
- 2
- 3
- 4
- 5
- 6
- Ditches
- EF Owyhee
- No Data

Blue creek res owner.shp
- B.L.M.
- Bureau of Indian Affairs
- Open water
- Private
- State of Idaho

Landuse-blue reservoir.shp
- Forest
- Irrigated-Gravity Flow
- Irrigated-Sprinkler
- Rangeland
- Riparian
- Blue res 5th field.shp

N

1   0   1   2   Miles

Blue Creek Reservoir
5th Field HUC
Landuse-Ownership
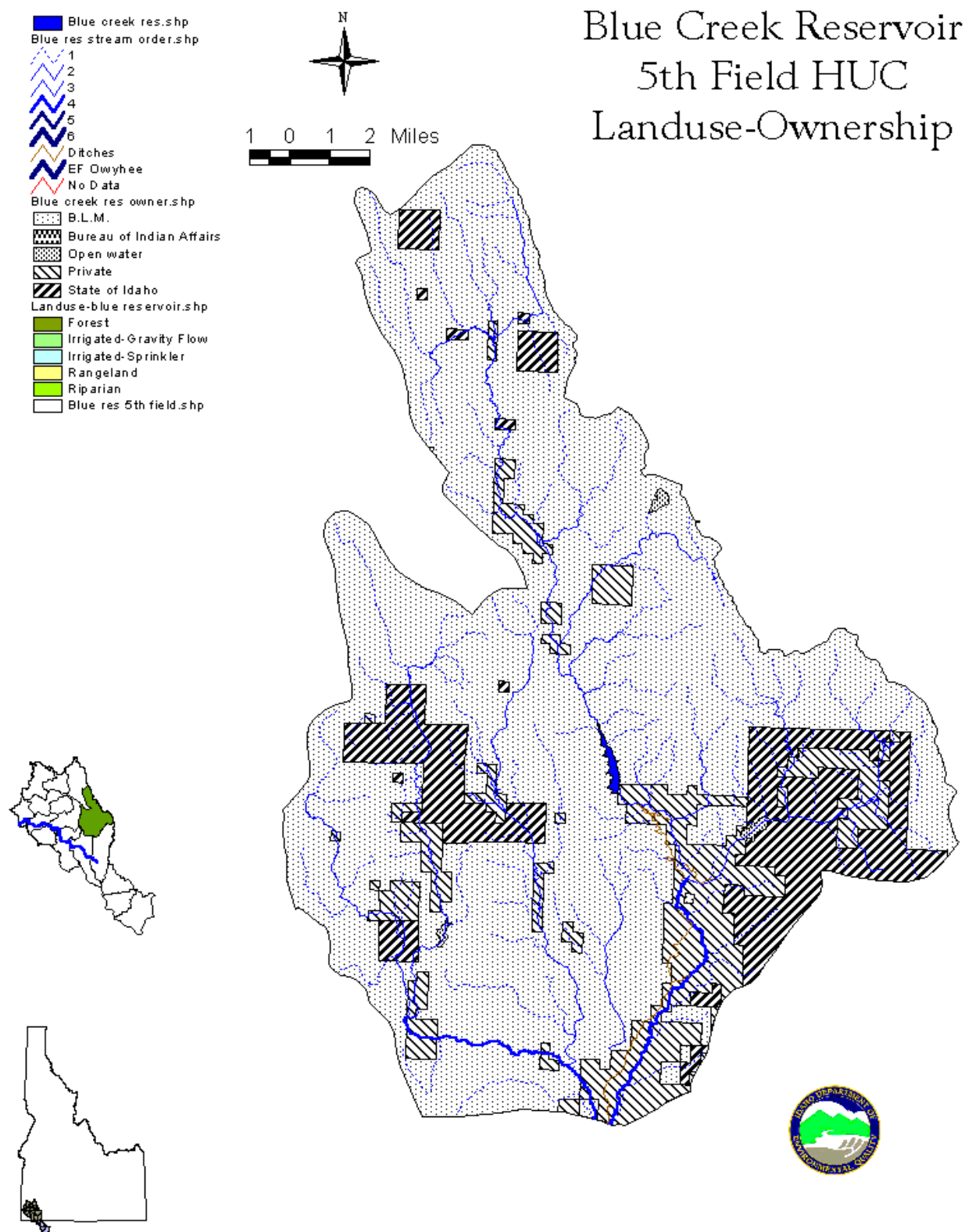
Deep Creek 5th Field HUC	Statistics
Total Area	71,598 acres
0-1st Order Streams	138.0 miles
2nd Order Streams	41 miles
3rd Order Streams	15.7 miles
4th Order Streams	10.7 miles
5th Order	11.8 miles
Canals/Ditches	2.8 miles
§303(d) Listed Segments	
Deep Creek	11.8 miles
Listed Pollutants(s)	Temperature/Sediment
Castle Creek	11.3 miles
Listed Pollutant	Temperature/Sediment
Pole Creek	5.6 miles
Listed Pollutants(s)	Temperature/Sediment
Land Use	
Rangeland	60,102.2 acres
Irrigated	
Forest	9,945.6 acres
Riparian	1,550.4 acres
Land Ownership/Management	
Private	4976 acres
State of Idaho	2066 acres
Federal (BLM)	64,556 acres
Other Water Bodies	
Beaver Creek	9.0 miles
Bull Gulch	0.4 miles
Carter Creek	3.7 miles
Cowboy Creek	6.3 miles
Dickshooter Creek	2.5 miles
Jobe Creek	1.5 miles
Lightening Creek	4.4 miles
Long Meadow Creek	5.4 miles
Moonshine Creek	2.4 miles
Skunk Creek	2.4 miles
Swisher Creek	2.1 miles
Brace Reservoir	

Deep Creek
5th Field
Landuse-Ownership

Deep creek 5th field.shp
Deep creek hydro.shp
1
2
3
4
5
6
Ditches
EF Owyhee
No Data
Deep creek ownership.shp
B.L.M.
Bureau of Indian Affairs
Open water
Private
State of Idaho
Landuse-deep cr.shp
Forest
Irrigated-Gravity Flow
Irrigated-Sprinkler
Rangeland
Riparian

N

1   0   1   2 Miles
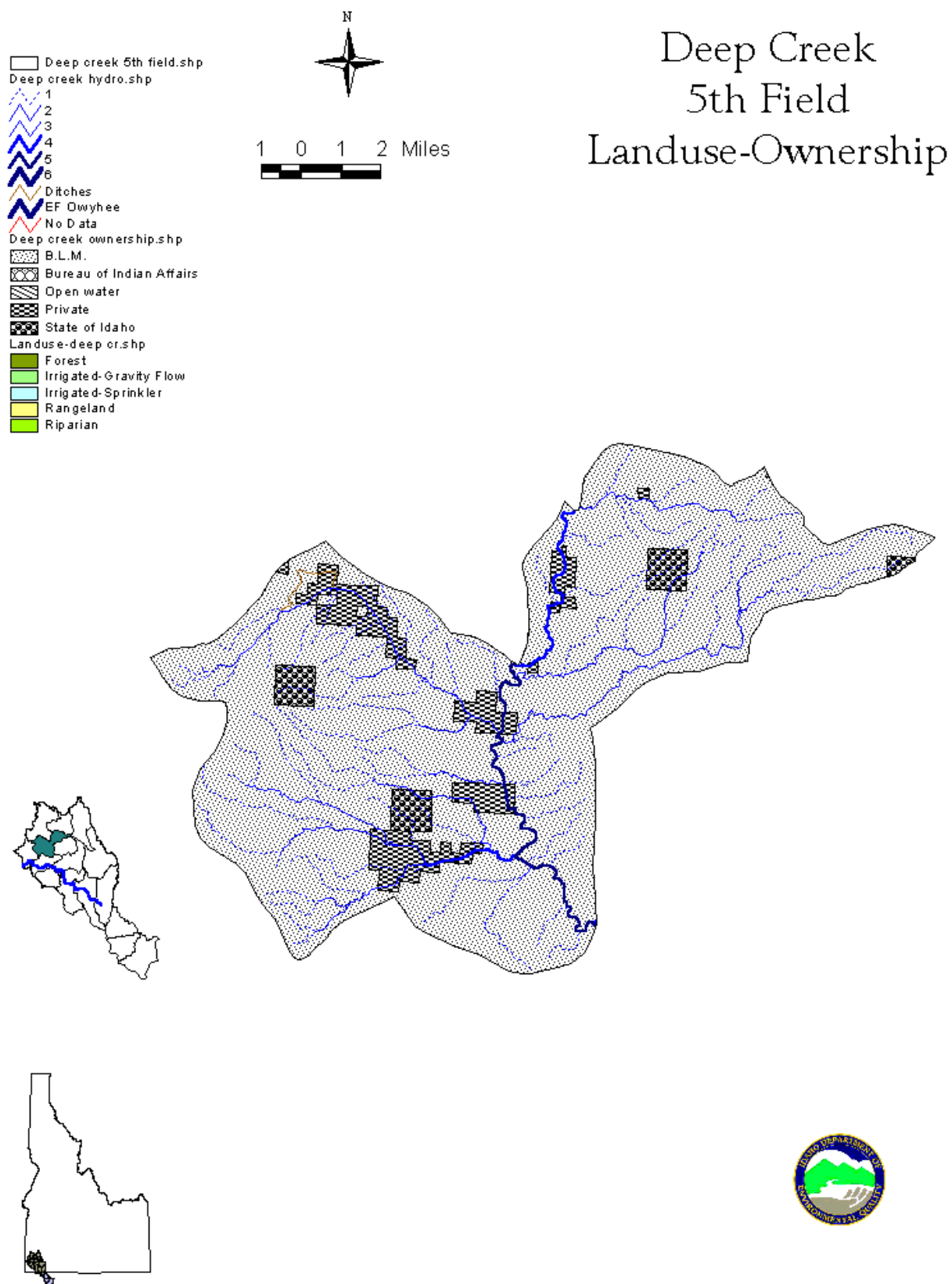
Lower Battle Creek 5th Field HUC	Statistics
Total Area	82,523 acres
0-1st Order Streams	112.1 miles
2nd Order Streams	24.1 miles
3rd Order Streams	4.6 miles
4th Order Streams	29.1 miles
§303(d) Listed Segments	
Battle Creek	29.0 miles
Listed Pollutants(s)	Bacteria
Land Use	
Rangeland	70,995 acres
Riparian	11,530 acres
Land Ownership/Management	
Private	539 acres
State of Idaho	2,886 acres
Federal (BLM)	79,098 acres
Other Water Bodies	
Cottonwood Draw	3.7 miles
Freshwater Draw	6.6 miles
Kelly Park	7.4 miles
Owyhee River	15.7 miles
Yatahoney Creek	3.8 miles
Unnamed	123.5 miles

Lower Battle Creek
5th Field HUC
Landuse-Ownership

Lower battle 5th field.shp
Low battle stream order.shp
1
2
3
4
5
6
Ditches
EF Owyhee
No Data
Low battle ownership.shp
B.L.M.
Bureau of Indian Affairs
Open water
Private
State of Idaho
Landuse-low battle.shp
Forest
Irrigated-Gravity Flow
Irrigated-Sprinkler
Rangeland
Riparian

N

1   0   1   2 Miles
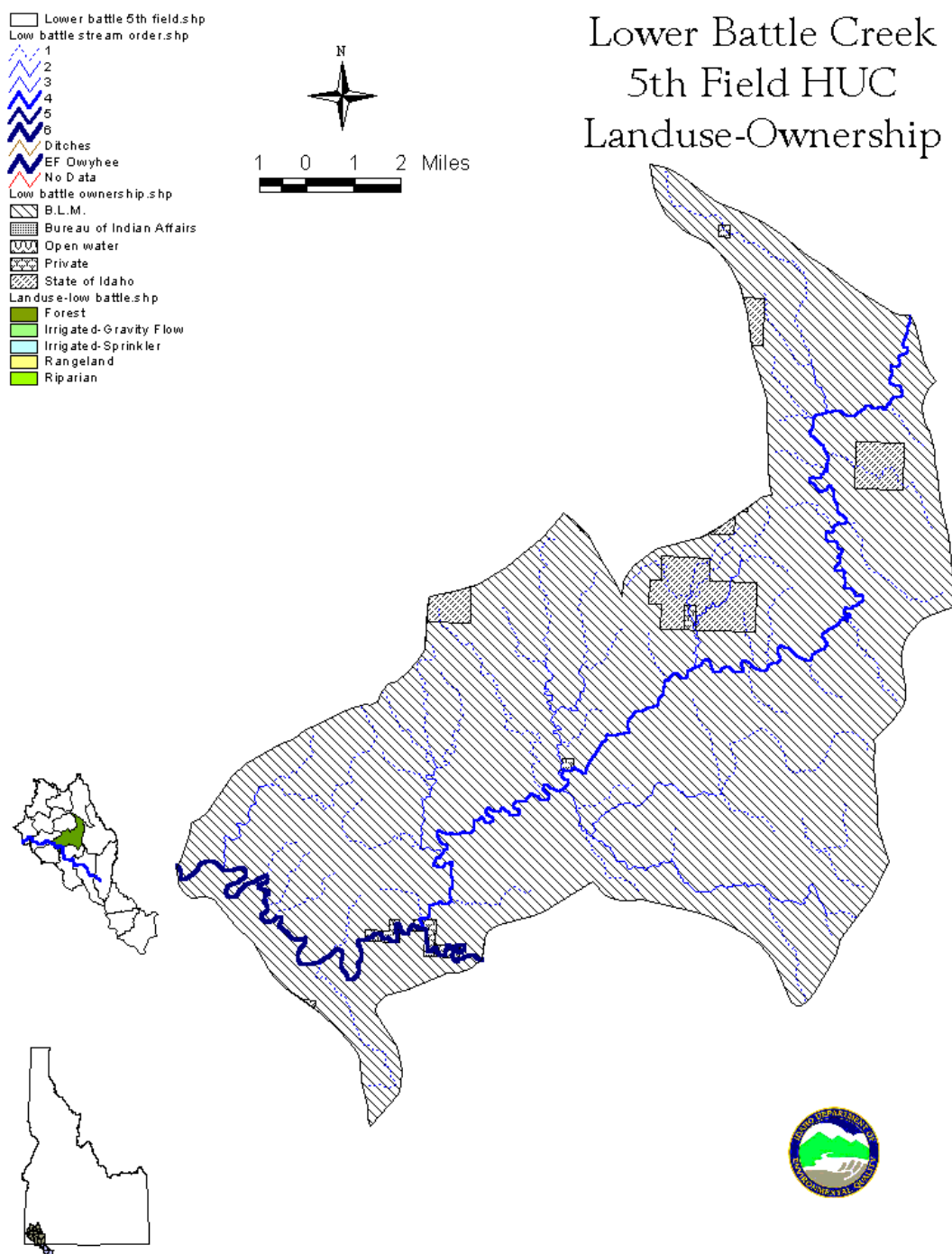
Table B4. Hurry Back Field HUC Statistics.

Hurry Back 5th Field HUC	Statistics
Total Area	98,406 acres
0-1st Order Streams	179.2 miles
2nd Order Streams	57.4 miles
3rd Order Streams	15.8 miles
4th Order Streams	23.4 miles
5th Order Streams	4.8 miles
Canals/Ditches	6.4 miles
§303(d) Listed Segments	
Deep Creek	13.0 miles
Listed Pollutant	Temperature/Sediment
Pole Creek	2.5 miles
Listed Pollutant	Temperature/Sediment
Nickel Creek	2.8 miles
Listed Pollutant	Sediment
Other Water Bodies	
Anne Valley Creek	9.3 miles
Corral Creek	5.4 miles
Cow Valley Canyon	2.5 miles
Crooked Creek	3.0 miles
Current Creek	13.6 miles
Deep Creek	13 miles
Hidden Valley Creek	2 miles
Hurry Back Creek	11.2 miles
Hurry Up Creek	4.8 miles
Jackass Creek	1.9 miles
Little Smith Creek	4.2 miles
Little Thomas Creek	6.2 miles
Nickel Creek	13.7 miles
Nip and Tuck Creek	9.1 miles
Pleasant Valley Creek	5.5 miles
Pole Creek	2.5 miles
Slack Creek	3.7 miles
Smith Creek	7.1 miles
Stoneman Creek	3.9 miles
Thomas Creek	4.7 miles

Unnamed	158 miles
Land Use	
Rangeland	49,694.4 acres
Forest	45,816.7 acres
Riparian	2891.3 acres
Land Ownership/Management	
Private	12,453 acres
State of Idaho	17,143 acres
Federal (BLM)	68,795 acres
Open Water	15 acres

Hurry back stream orders.shp
1
2
3
4
5
6
Ditches
EF Owyhee
No Data
Hurry back ownership.shp
B.L.M.
Bureau of Indian Affairs
Open water
Private
State of Idaho
Landuse-hurry back.shp
Forest
Irrigated-Gravity Flow
Irrigated-Sprinkler
Rangeland
Riparian
Hurry back 5th field.shp
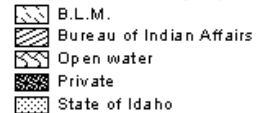
N

1   0   1   2   Miles

Hurry Back
5th Field HUC
Landuse-Ownership
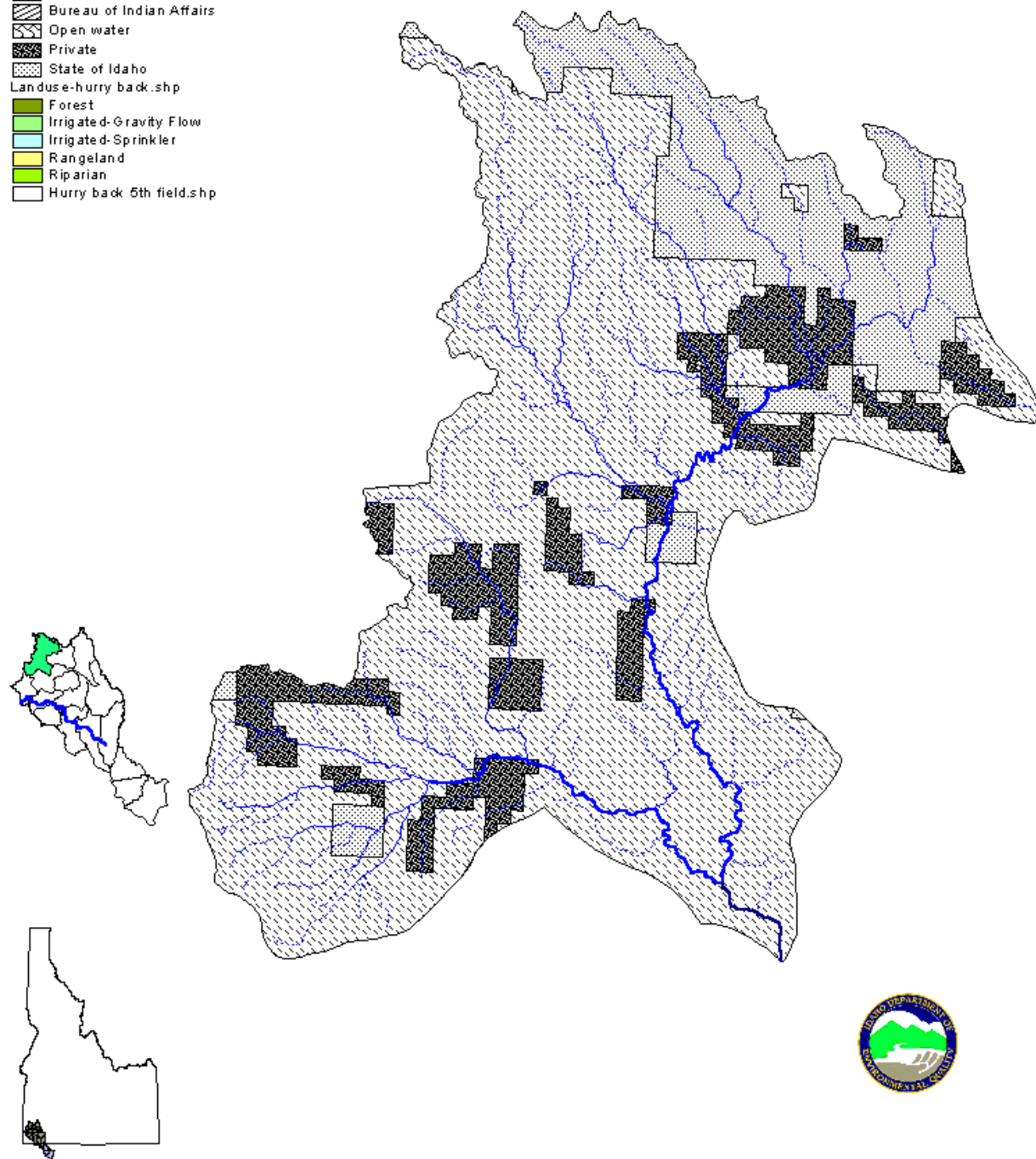
Table B5. Lower Owyhee 5th Field HUC Statistics.

Lower Owyhee 5th Field HUC	Statistics
Total Area	
0-1st Order Streams	62.7 miles
2nd Order Streams	0.3 miles
3rd Order Streams	14.8 miles
5th Order Streams	11.6 miles
EF Owyhee River	20.3 miles
§303(d) Listed Segments	
Deep Creek	
Listed Pollutant	Temperature Sediment
Other Water Bodies	
Cherry Gulch	3.1 miles
Paiute Creek	1.4 miles
Porcupine Creek	7.3 miles
Unnamed	67.5 miles
Land Use	
Rangeland	47,969 acres
Riparian	5,459 acres
Land Ownership/Management	
Private	168 acres
State of Idaho	595 acres
Federal (BLM)	52,664 acres

Low owy sream order.shp
1
2
3
4
5
6
Ditches
EF Owyhee
EF Owyhee
Lower owyhee 5th field landuse.shp
Forest
Irrigated-Gravity Flow
Irrigated-Sprinkler
Rangeland
Riparian
Lower owy 5th field.shp
Low owyhee ownership.shp
B.L.M.
Bureau of Indian Affairs
Open water
Private
State of Idaho

N

0.8   0   0.8   1.6   Miles

Lower Owyhee
5th Field HUC
Landuse-Ownership
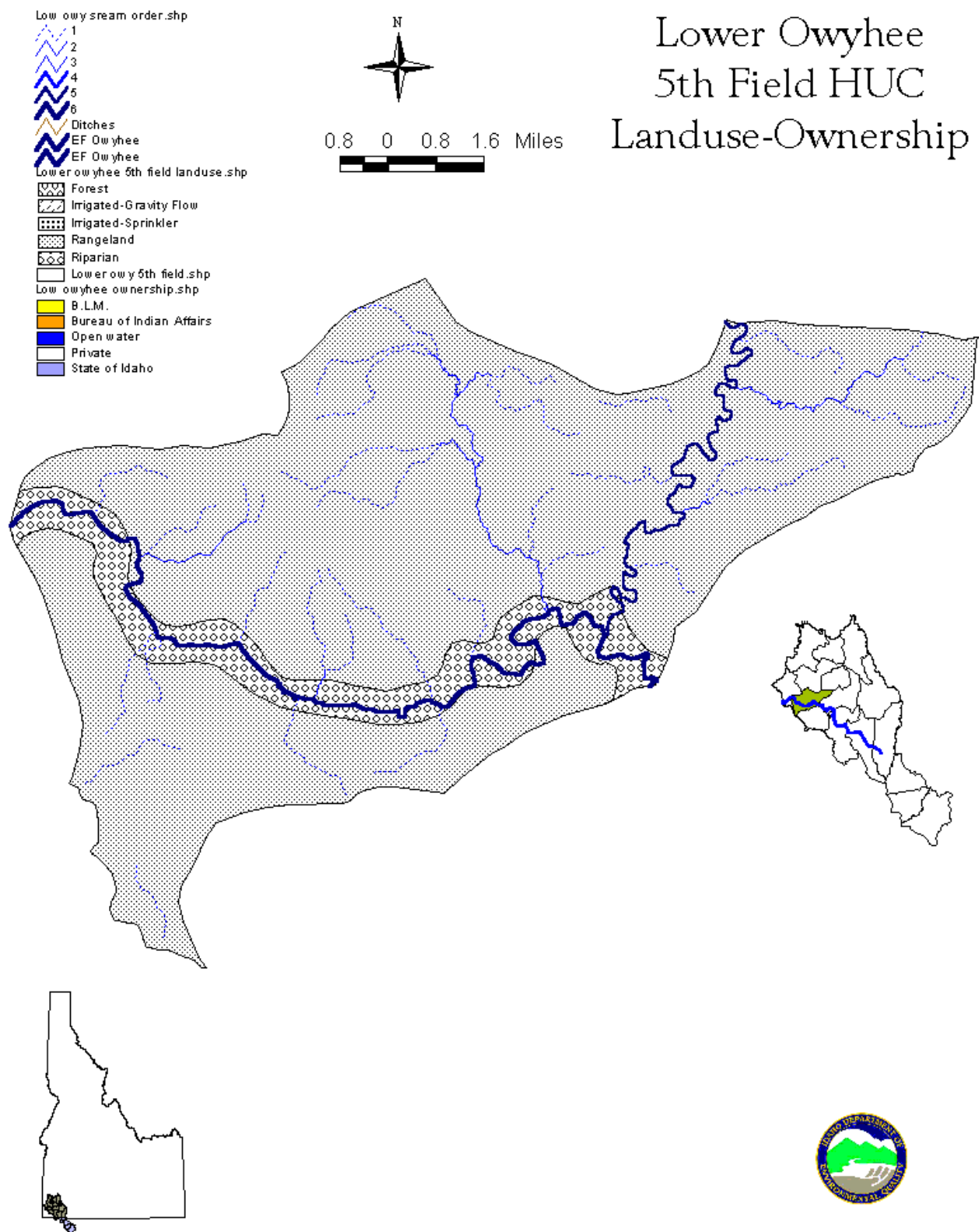
Table B6. Paiute Creek 5th Field HUC Statistics.

Paiute Creek 5th Field HUC	Statistics
Total Area	50,634 acres
0-1st Order Streams	91.0 miles
2nd Order Streams	20.2 miles
3rd Order Streams	8.7 miles
4th Order Streams	6.5 miles
5th Order Streams	
Canal/Ditches	0.1 miles
§303(d) Listed Segments	
none	
Other Water Bodies	
Paiute Creek	15.7 miles
Unnamed	110.8 miles
Land Use	
Rangeland	49,707 acres
Riparian	926.7 acres
Land Ownership/Management	
State of Idaho	2,696 acres
Federal (BLM)	47,938 acres

Paiute Creek
5th Field
Landuse-Ownership

Paiute 5th Field HUC
Paiute Stream Orders
1
2
3
4
5
6
Ditches
EF Owyhee
No Data
Paiute Ownership
B.L.M.
Bureau of Indian Affairs
Open water
Private
State of Idaho
Paiute Landuse
Rangeland
Riparian
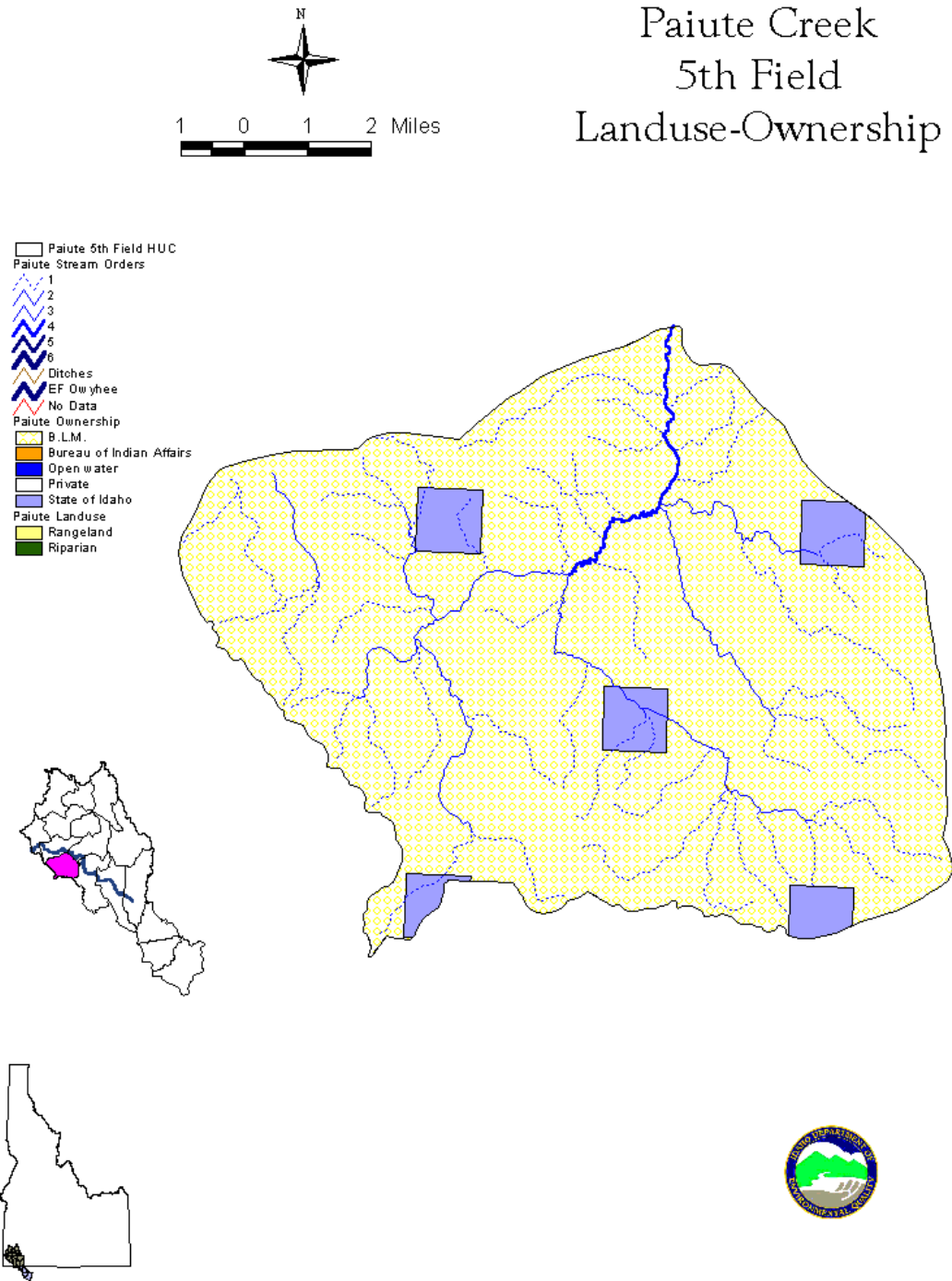
Table B7. Pole Creek 5th Field HUC Statistics.

Pole Creek 5th Field HUC	Statistics
Total Area	54,551 acres
0-1st Order Streams	100.1 miles
2nd Order Streams	17.7 miles
3rd Order Streams	15.7 miles
4th Order Streams	8.3 miles
Canals/Ditches	4.8 miles
§303(d) Listed Segments	
Pole Creek	19.2 miles
Listed Pollutants(s)	Temperature/Sediment
Other Water Bodies	
Camas Creek	14.0 miles
Camel Creek	5.4 miles
Slack Creek	5.5 miles
Sunshine Valley Creek	2.7 miles
Unnamed	99.8 miles
Land Use	
Rangeland	54,551 acres
Land Ownership/Management	
Private	5,763
State of Idaho	3507
Federal (BLM)	45,281

Pole cr.shp
Pole creek stream order.shp
1
2
3
4
5
6
Ditches
EF Owyhee
No Data
Pole creek ownership.shp
B.L.M.
Bureau of Indian Affairs
Open water
Private
State of Idaho
Landuse-pole creek.shp
Forest
Irrigated-Gravity Flow
Irrigated-Sprinkler
Rangeland
Riparian

N

0.7   0   0.7   1.4   Miles

Pole Creek
5th Field HUC
Landuse-Ownership
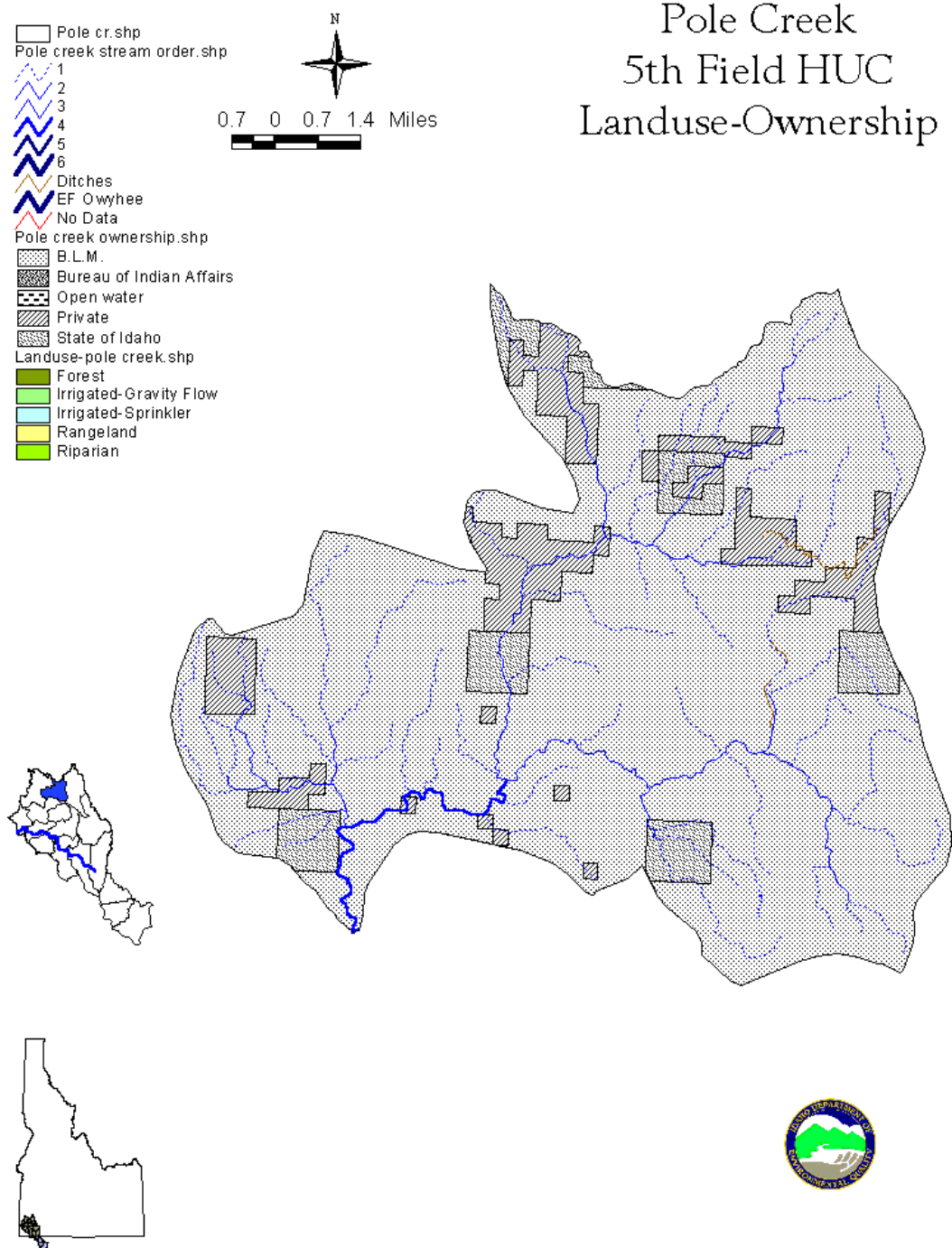
Table B8. Red Canyon 5th Field Statistics.

Red Canyon 5th Field HUC	Statistics
Total Area	49,897.4 acres
0-1st Order Streams	83.6 miles
2nd Order Streams	23.5 miles
3rd Order Streams	13.8 miles
4th Order Streams	3.0 miles
5th Order Streams	7.5 miles
§303(d) Listed Segment	
Red Canyon Creek	5.1 miles
Listed Pollutant	Temperature/Sediment
Other Water Bodies	
Petes Creek	7.9 miles
Bull Basin Creek	7.2 miles
Red Basin Creek	8.3 miles
East Fork Red Canyon Creek	6.0 miles
West Fork Red Canyon Creek	8.2 miles
East Fork Owyhee River	7.2 miles
Cow Creek	4.0 miles
Land Use	
Rangeland	26,250.6 acres
Forest	20,343.4 acres
Riparian	3,303.3 acres
Land Ownership/Management	
Private	453 acres
Federal (BLM)	49,445 acres

Red Canyon Creek
5th Field
Landuse-Ownership
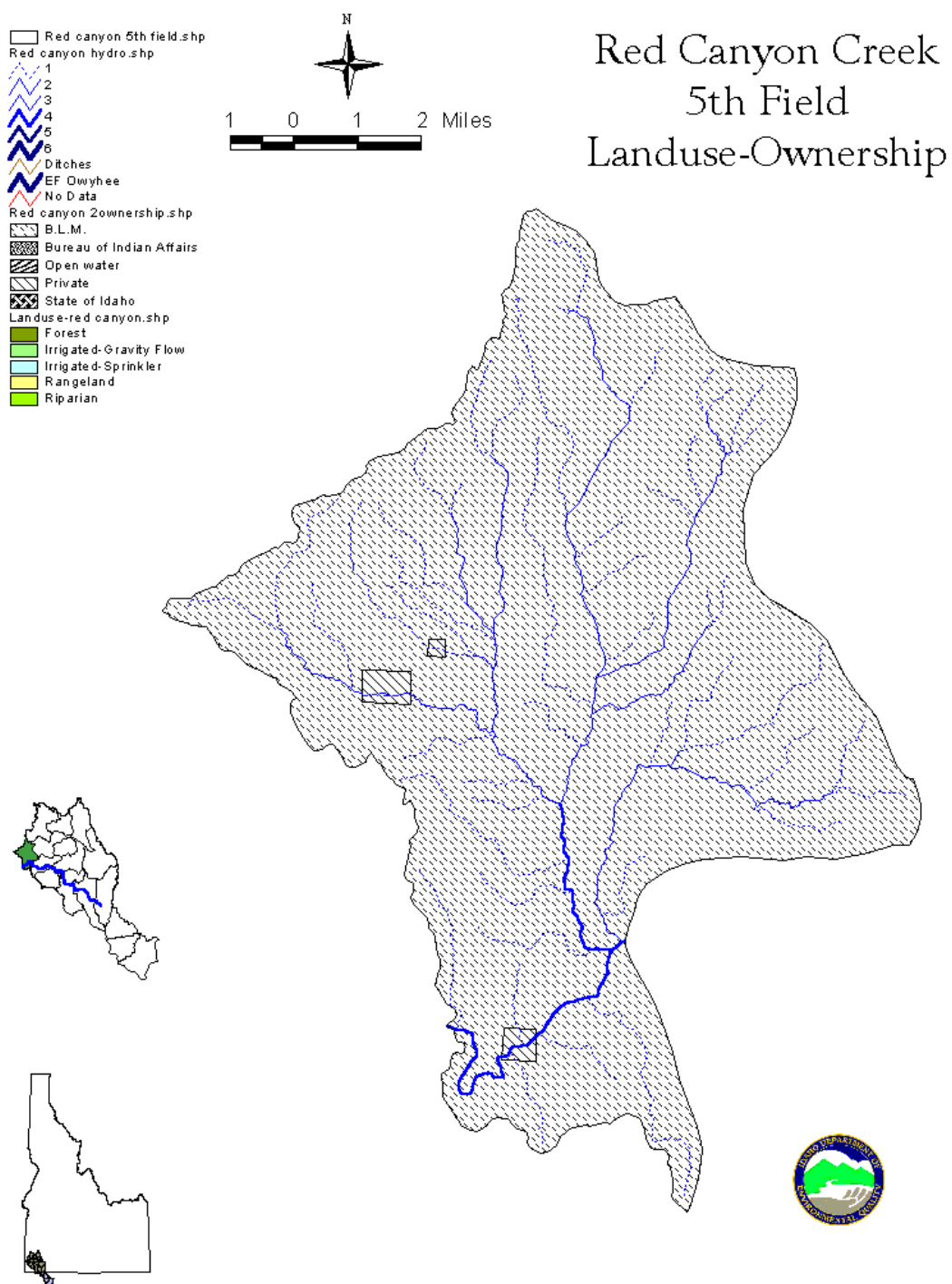
Table B9. Ross Lake 5th Field HUC Statistics.

Ross Lake 5th Field HUC	Statistics
Total Area	110,009
0-1st Order Streams	88.3 miles
2nd Order Streams	19.3 miles
3rd Order Streams	5.8 miles
Canal/Ditches	17.0 miles
East Fork Owyhee	24.1 miles
§303(d) Listed Segments	
None	
Other Water Bodies	
Billy Shaw Slough	2.5 miles
Ross Slough	10.3 miles
Unnamed	112.0 miles
Land Use	
Rangeland	77,274 acres
Forest	acres
Riparian	1,452 acres
Land Ownership/Management	
Private	299 acres
State of Idaho	84 acres
Federal (BLM)	16,208 acres
Open Water	2,297 Acres
Federal (Tribal)	59,839 acres

Ross Lake
5th Field HUC
Landuse-Ownership
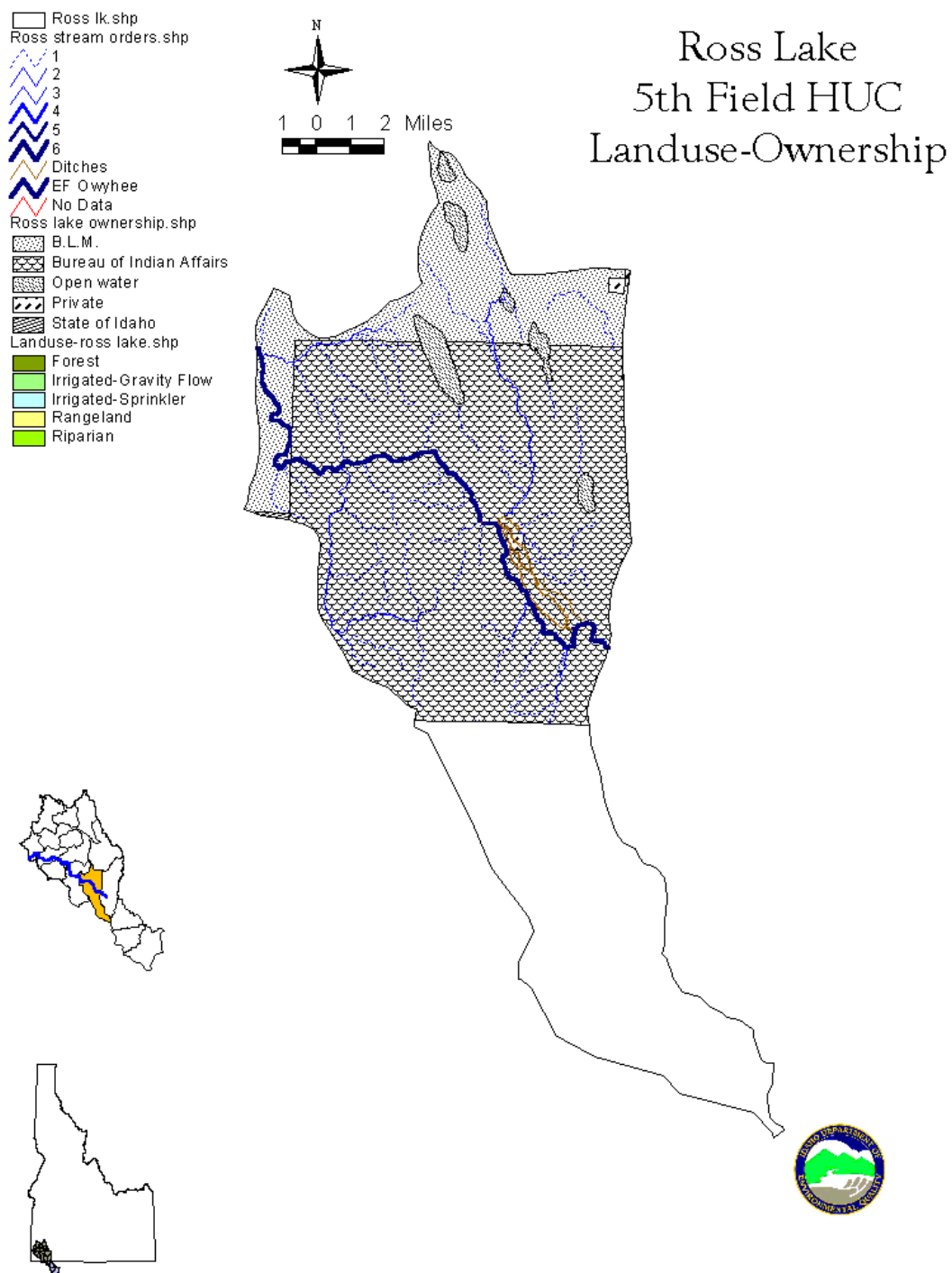
Table B10. Dickshooter 5th Field HUC Stats.

Dickshooter 5th Field HUC	Statistics
Total Area	49,010 acres
0-1st Order Streams	88.4 miles
2nd Order Streams	20.6 miles
3rd Order Streams	6 miles
4th Order Streams	14 miles
§303(d) Listed Segments	
None	
Listed Pollutants(s)	
Other Water Bodies	
Dickshooter Creek	22.5 miles
Unnamed	106.9 miles
Land Use	
Rangeland	49,009 acres
Land Ownership/Management	
Private	427 acres
State of Idaho	2678 acres
Federal (BLM)	45,904 acres

Dickshooter
5th Field HUC
Landuse-Ownership

Dickshooter 5th field.shp
Dick shoot stream order.shp
1
2
3
4
5
6
Ditches
EF Owyhee
No Data
Dick shooter ownership.shp
B.L.M.
Bureau of Indian Affairs
Open water
Private
State of Idaho
Landuse-dick shooter.shp
Forest
Irrigated-Gravity Flow
Irrigated-Sprinkler
Rangeland
Riparian

0.7   0   0.7   1.4   Miles

N
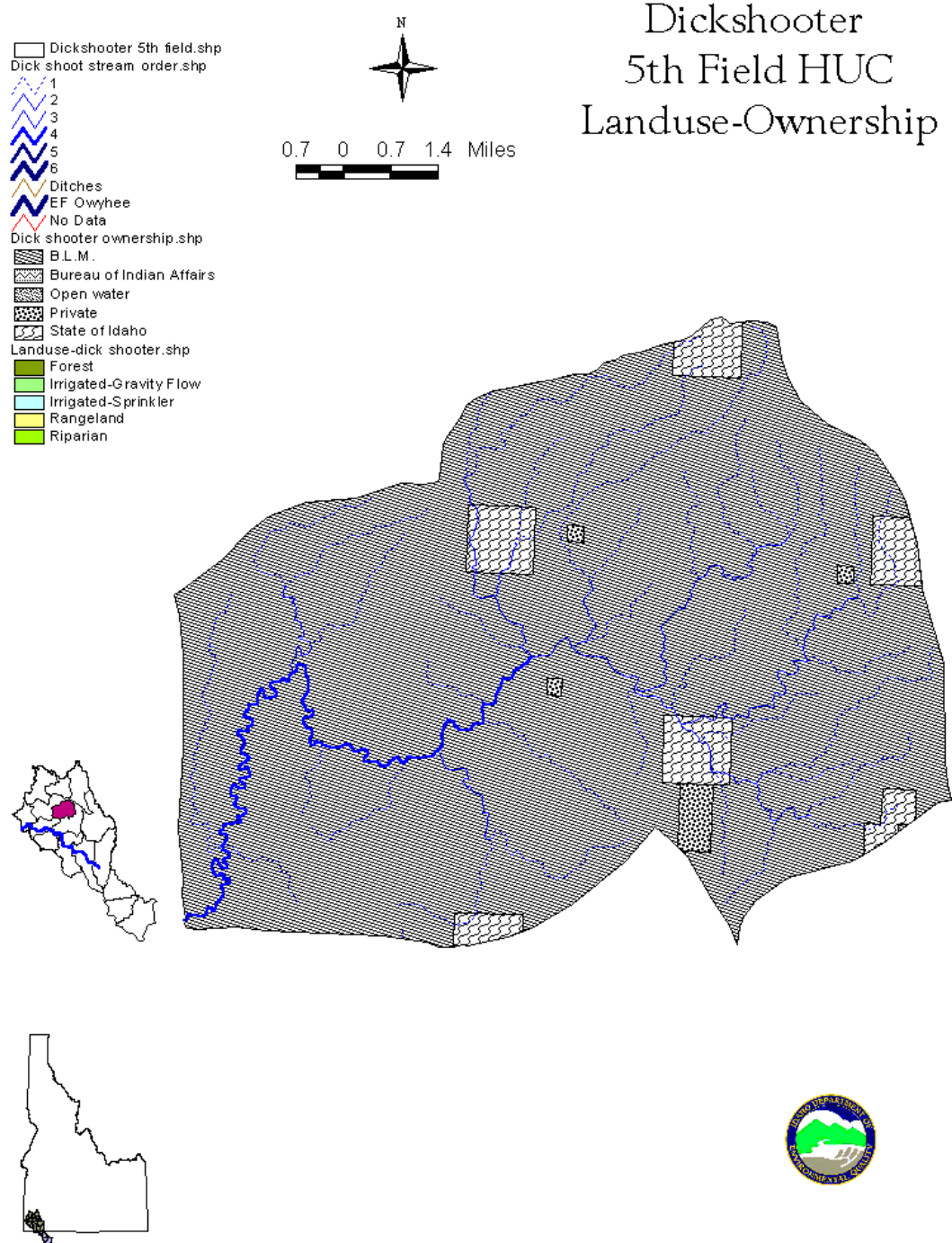
Table B11. Upper Battle Creek 5th Field HUC Statistics.

Upper Battle Creek 5th Field HUC	Statistics
Total Area	100,651 acres
0-1st Order Streams	140.5 miles
2nd Order Streams	50.9 miles
3rd Order Streams	28.4 miles
4th Order Streams	2.7 miles
Canal/Ditches	26.7 miles
§303(d) Listed Segments	
Battle Creek	35.5 miles
Listed Pollutants(s)	Bacteria
Other Water Bodies	
Big Springs Creek	15.8 miles
Dry Creek	15.0 miles
Rock Creek	4.8 miles
Unnamed	178.1 miles
Land Use	
Rangeland	88,979.8 acres
Irrigated	1,493.3 acres
Riparian	10,178.6 acres
Land Ownership/Management	
Private	12,169 acres
State of Idaho	6,500 acres
Federal (BLM)	81,911 acres
Open Water	71 acres

Upper Battle Creek
5th Field HUC
Landuse-Ownership
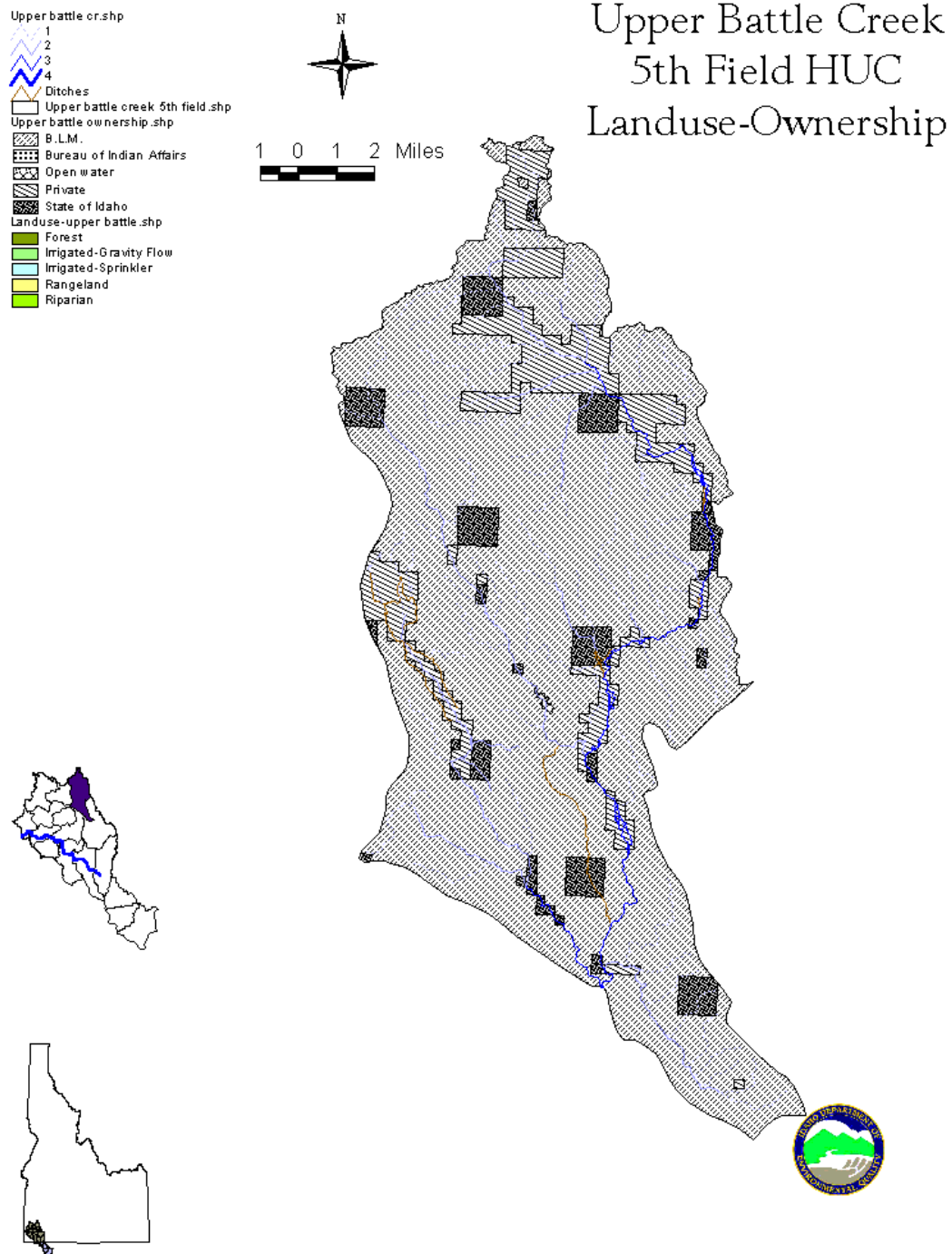
Table B12. Yatahoney 5th Field HUC Statistics.

Yatahoney Creek 5th Field HUC	Statistics
Total Area	90,528 acres
0-1st Order Streams	118 miles
2nd Order Streams	34.8 miles
3rd Order Streams	12.9 miles
4th Order Streams	9.7 miles
6th Order	16.6 miles
Canals/Ditches	7.4 miles
§303(d) Listed Segments	
Juniper Basin Reservoir	749 acres
Listed Pollutant	Sediment
Other Water Bodies	
Juniper Creek	13.1 miles
Owyhee River	16.6 miles
Yatahoney Creek	19.9 miles
Unnamed	155.2 miles
Land Use	
Rangeland	84,920 acres
Riparian	5,563.3 acres
Land Ownership/Management	
Private	749 acres
State of Idaho	2,856 acres
Federal (BLM)	82,750 acres
Open Water	749 acres

Yatahoney Creek
5th Field
Landuse-Ownership
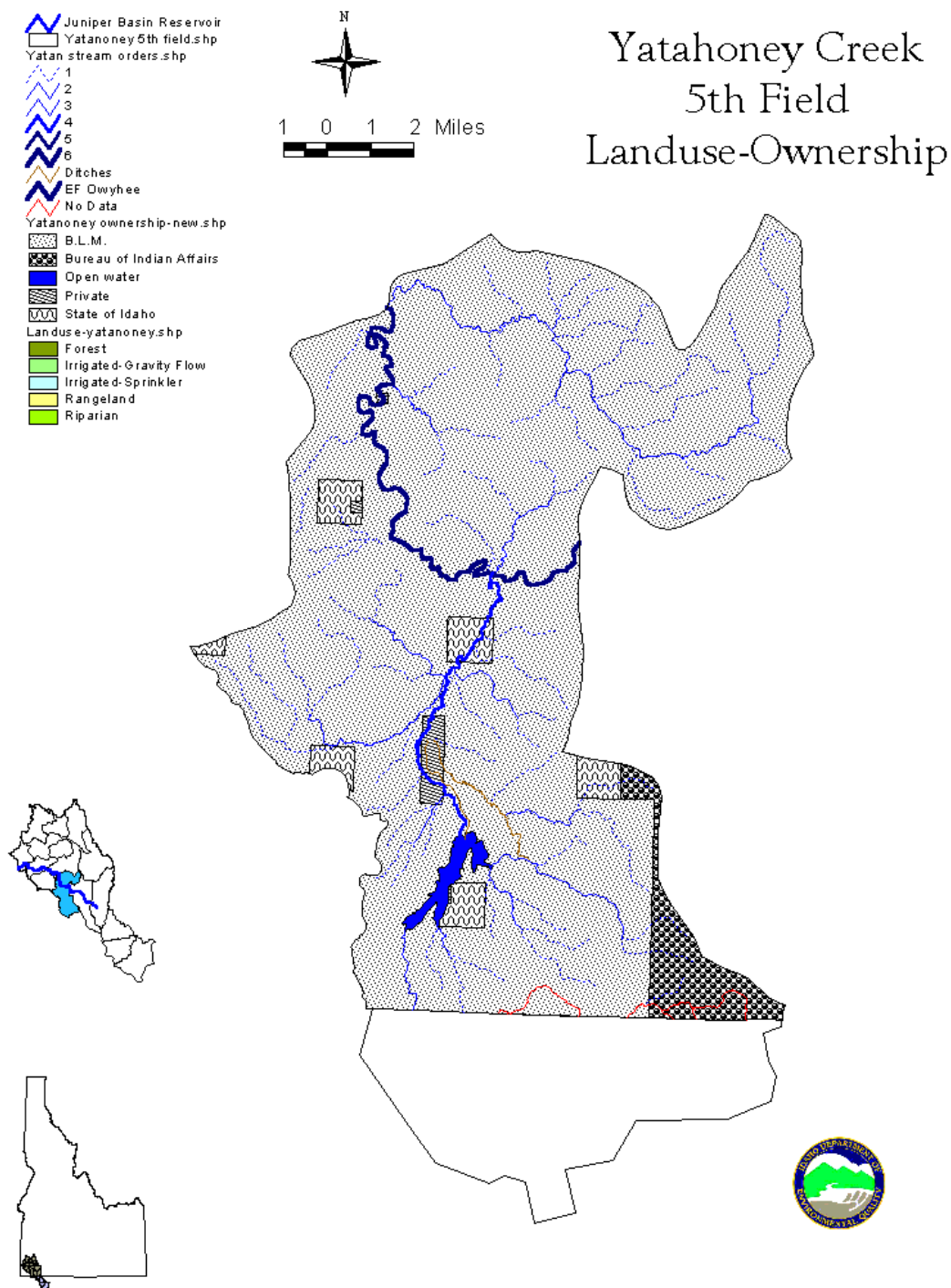
Appendix C. Data Sources

Table C1. Data Sources for Upper Owyhee Watershed Subbasin Assessment.

Water Body	Data Source	Type of Data	When Collected
Deep Creek, Nickel Creek, Pole Creek, Castle Creek, Red Canyon Creek	Idaho Department of Environmental Quality, Boise Regional Office	Temperature	2000 and 2001
Battle Creek and Shoofly Creek	Idaho Department of Environmental Quality, Boise Regional Office	Bacteria	2000 and 2001
Juniper Basin Reservoir and Blue Creek Reservoir	Idaho Department of Environmental Quality, Boise Regional Office	Turbidity	2001
Pole Creek, Castle Creek, Deep Creek, Nickel Creek	United States Department of Interior, Bureau of Land Management	Fish	1999-2000
Various Streams in Watershed	Idaho Department of Environmental Quality, Boise Regional Office	Beneficial Use Reconnaissance Program Data	1991-1998

Appendix D. Stream Segment Temperature Model (SSTEMP) and Hydrology Model

Modeling Approach

SSTEMP and SSSHADE were the models used to assess the effects of solar radiation, channel morphology and instream flow on temperature in stream segments of the Upper Owyhee Watershed. The models were developed to help predict the consequences of manipulating various factors influencing water temperature. SSSHADE is a stream shading model which is used to provide input variables to the SSTEMP model. SSSHADE estimates stream shading from various riparian (vegetation) and topographic conditions

SSTEMP and SSSHADE require input data for 28 parameter and state variables ranging from channel conditions to climate. Many of these were kept constant for all model runs. Several parameters were varied to assess the impact of various factors. The following is a model input parameters are described below.

Input Values and Model Calibration

Stream Network Hydrology:

Segment Inflow: For all situations with streams with headwaters, this value was set at zero. For segments streams that are confluence of two streams this value was set at the addition of the flow from both water bodies. Flow was determined with the use of the flow model developed by Hortness and Berenbrock (2001). The flow model will be discussed later.

Inflow Temperature: For all situations with streams with headwaters, this value was set at 8.3^{o}C. For streams that are confluence of two streams this value was set based on the flow from both water bodies and the following formula:

$$T_j = \frac{(Q_1 * T_1) + (Q_2 * T_2)}{Q_1 + Q_2}$$

where: T_j = water temperature below junction

Q_n = discharge of source n

T_n = water temperature of source n

Stream Outflow: This value was obtained by calculating the inflow through the discharge model (Hortness and Berenbrock 2001). There is no allowance for reaches that are losing or gaining reaches. Thus, discharge is a steady state where outflow equals inflow from the beginning of the reach plus any inflow determined by the hydrology model.

Accretion Temperature: This the expected ground water temperature. This value is calculated by determining the average yearly temperature. Using the average yearly temperature obtained from the National Weather Service at the Boise City Municipal Airport (Boise, Idaho), a ground water temperature of 8.3^{o} C was obtained. To calculate the difference in the average yearly temperature the following formula was used:

$$T_a = T_o + C_t * (Z - Z_0)$$

where: T_a = average yearly air temperature at elevation E (^{o}C)
T_o = average air temperature at elevation Eo (^{o}C)
$\quad\quad$ Z = Mean elevation of segment
$\quad\quad$ Z_o = elevation at station (Boise)
$\quad\quad$ C_t = moist adiabatic lapse rate (-0.00656 ^{o}C/m)

Stream Network Geometry:

Segment Lengths: Derived from the stream reach length from GIS coverages.

Latitude: Used 0.733 radians (42.0^o) for all segments representing the lowest latitude of the study area.

Dams at Heads of Segments: No dams were figured into the model.

Upstream Elevation: Determined for each stream reach from USGS 7.5-minute quad maps.

Downstream Elevation: Determined for each stream reach from USGS 7.5-minute quad maps.

Width's A Term: The initial value was determined with the model. The width/depth ratio was set near 25 for all streams. The width/depth ratio was set at this value based on the limited BURP data. Width was then calculated through the model based on discharge (flow) input and calculated stream gradient. The width value was changed to obtain a possible width/depth ratio of near 12 to obtain a possible value once stream morphology conditions improve in response to changes in riparian vegetation and streambank conditions.

The use of the wetted width is an accepted input parameter if the stream width is not varied during the model run (Bartholow 1999). If wetted width is used, then the width's B Term is zero.

B Term where W = A*Q*B: This input is a calculated formula using available flow data. With limited flow data for the Upper Owyhee Watershed, this value was set at zero.

Manning's n: A default value of 0.035 was used because of the variability of substrate in the Upper Owyhee Watershed. The substrate varies from sand-silt to large boulders. The gradient can vary from 1-6%.

Stream Network Meteorology:

Air Temperature: The daily mean air temperature for the month of June was calculated from the mean daily temperature from the National Weather Service in Boise, Idaho. The Boise mean daily air temperature was used due to the fact that field data temperature loggers could not be in place early in the season due to travel difficulties and reluctance to leave data loggers out through the winter. To compensate for the possible difference in air temperature from Boise to the Upper Owyhee Watershed, the following formula was used:

$$T_a = T_o + C_t * (Z - Z_0)$$

where: T_a = average yearly air temperature at elevation E (^{o}C)

T_o = average air temperature at elevation Eo (^{o}C)

Z = Mean elevation of segment

Z_o = elevation at station (Boise)

C_t = moist adiabatic lapse rate (-0.00656 ^{o}C/m)

Daily mean air temperatures for the months of July and August were calculated using temperature data recorded by data loggers in place in the watershed. The ambient air temperature-monitoring site was located at approximately 1,500 meters (4921 feet) elevation near the confluence of Castle Creek and Deep Creek.

Maximum Air Temperature: For the month of June the model calculated the monthly maximum temperature. Once again the lack of data prevented the use of actual in-field data. With the high probability of a wide variance of data from the beginning of the month to the end of the month, it was decided the model would be sufficient for calculating the mean monthly maximum air temperature for June.

For July and August, the actual mean monthly air temperature was used. The ambient air temperature monitoring site was located at approximately 1,500 meters (4921 feet) elevation near the confluence of Castle Creek and Deep Creek.

Relative Humidity: Relative humidity was set at 61.2% for the months of June, July and August. This value was determined sing the average relative humidity obtained from the National Weather Service in Boise, Idaho. The value obtained from Boise was then corrected for elevation using the following formula:

$$Rh = R_o * [1.6040^{\wedge}(T_o - T_a)] * [T_a + 273.16)/(T_o + 273.16)]$$

where: Rh = relative humidity for temperature T_a

R_o = relative humidity at station T_a

T_a = air temperature at segment

To = air temperature at station

$\wedge$ = exponentiation

$0 <= Rh <= 1$

Wind Speed: The value obtained was from the National Weather Service in Boise, Idaho and averaged for June, July and August.

Ground Temperature: Using the average yearly air temperature obtained from the National Weather Service at the Boise City Municipal Airport (Boise, Idaho) after calibrating for altitude difference the value of 8.3^{o}C was obtained. To calculate the difference in the average yearly temperature the following formula was used:

$$T_a = T_o + C_t * (Z - Z_0)$$

where: T_a = average yearly air temperature at elevation E (^{o}C)

T_o = average air temperature at elevation Eo (^{o}C)

Z = Mean elevation of segment
Z_o = elevation at station (Boise)
C_t = moist adiabatic lapse rate (-0.00656 ^{o}C/m)

Thermal Gradient: A default setting of 1.65joules/m^2/second was used.

Possible Sun: This value was obtained from the National Weather Service in Boise, Idaho and averaged for June, July and August. Value set at 76% for all three months of the model run.

Dust Coefficient: The input value was set at 6 units for entire run of the model. The input value range is 3 to 10 as supplied by Bartholow (1999) and taken from Tennessee Valley Authority (1972). The middle value was used as the input value due to a lack of data.

Ground Reflectivity: The input value was set at 15 and represents flat ground and rock (range 12-15). The high value was selected due to bare soils with high amounts of silt and sand in the surrounding soils.

Solar Radiation: Model defined.

Stream Network Shade:

Shade: Model generated based on input values for calibration. Shade then adjusted to obtain WQS criteria. Shade contains both topographic and vegetation shade. Topographic shade determined by value input from topographic attitude. Vegetation shade is then determined by model as shade increases. That is, since the topographic shade is a steady state input, as total shade is increased this would represent an increase in vegetation shade.

Stream Network Optional Shading Parameters:

Shading parameters are optional inputs. For the Upper Owyhee these values were entered during calibration reasons. Most of the values were entered using available data. In most incidences, once the required reductions (Joules/m^2/sec) were calculated these parameters were ignored by the model.

Segment Azimuth: This was determined from USGS 7.5-minute topographic maps. Since most streams have a general north to south flow (headwaters to mouth) this input value was set at zero (0.00 radians) for most streams. Two streams have northwest to southeast and southwest to northwest aspects with the input value set at either +45° (+(0.785 radians)) or –45° (–0.785 radians).

Topographic Attitude: This input value was the most difficult to determine and was usually set at 45° (0.785 radians) due to the steepness of the canyons. In many incidences, this value then converted to a topographic shading factor of 35%. This input value was entered for both the west and east sides of the water bodies. For two streams that do not have steep canyons, the value was set at 10° (0.175 radians). This value was determined from USGS 7.5 minute topographic maps.

Vegetation Height: Most of the riparian woody vegetation associated with riparian areas in the Upper Owyhee Watershed is of willows (S*alix sp.*). Some of the willow species that can be encountered include whiplash willow (*S. lasiandra*), sandbar willow (*S. longifollia*), and coyote willow (*S. exigua*). Most of these species are low lying shrubs with a canopy height between 7 and 15 feet. To offset for different species, an input value of 10 feet was set as default for vegetation height. In almost all model runs, vegetation shading calculated to be 0%.

Vegetation Crown: Many of the aspects discussed in vegetation height hold true for the vegetation crown. Most of the woody vegetation in the riparian areas Of the Upper Owyhee Watershed is low-brushy species with multiple shoots creating a dense canopy. To offset for different species encountered, input value of ten (10) feet was set as default for vegetation canopy on both the west and east sides. In almost all model runs, vegetation shading was calculated at zero percent (0%).

Vegetation Offset: Vegetation offset is the distance from the center of the water body to the main trunk of the vegetation. This input value was set at 20) feet as a default. Little information is available to assist with providing an accurate estimate. In almost all model runs, vegetation shading was calculated to be 0%.

Vegetation Density: Bartholow (1999) suggested a dense emergent vegetation cover could have a vegetation density 90%. This value was used as the input for vegetation density. It was shown that this factor had little influence on most streams due to vegetation height, crown and offset.

Stream Network Time of Year:

Time of Year: The value was set at the 15th for June, July and August. This computes an average value for a 30 day model run. This value is most important for determining length of day and sun angle.

Output Values

Stream Segment Intermediate Values:

Day Length: This value is determined by the input for time of year and latitude.

Slope: Calculated from input values for elevation change and stream length

Width: This is the same as the width input value.

Depth: Calculated from segment outflow, gradient and depth.

Vegetation Shade: Total shade minus topographic shade. Vegetation shade may vary based on time of year and azimuth inputs.

Topographic Shade: The model calculates this from input for latitude, time of year, azimuth, and topographic attitude.

Stream Segment Mean Heat Flux (Inflow or Outflow):

Convection: Convection component heat flux gain or loss at inflow or at outflow.

Atmosphere: Atmosphere component heat flux gain.

Conduction: Conduction component heat flux gain or loss at inflow or outflow.

Friction: Friction component heat flux gain or loss.

Evaporation: Friction component heat flux gain or loss at inflow or outflow.

Solar: Solar component heat flux gain or loss.

Background Radiation: Background radiation component heat flux gain or loss at inflow or outflow.

Vegetation: Vegetation component heat flux gain or loss.

Net: Net increase or decrease of heat flux from the sum of the above mentioned components.

Stream Segment Model Results-Outflow Temperature:

Predicted Mean Temperature: Model predicted mean daily water temperature in relation to model inputs.

Estimated Maximum Temperature: Model estimated maximum water daily temperature.

Approximate Minimum Temperature: Model approximated minimum daily water temperature (mean temperature - (maximum temperature-mean temperature)).

Mean Equilibrium: Model mean daily water temperature equilibrium if conditions remain the same.

Maximum Equilibrium: Model maximum daily water temperature equilibrium which maximum temperature may approach.

Minimum Equilibrium: Model minimum daily water temperature which minimum temperature may approach (equilibrium mean temperature - (equilibrium maximum temperature - equilibrium mean temperature)).

Model Validation

The model was validated by determining the root mean square error for both the average daily temperatures and the maximum daily temperatures for the months of July and August 2000.

Unfortunately, the available data consisted of only five data points for July and only four data points for August.

The following tables describe the results for validation of the SSTEMP Model and those water temperatures found in water bodies in the Upper Owyhee Watershed. Overall the model has provided a reasonable estimate of predicting current conditions and establishing reasonable guidance for predicting water temperature changes by increasing the amount of shade.

Table D1. Validation Results for July 2000.

	Actual Measured Daily Average C^o	Predicted Daily Average C^o	Actual Measured Daily Maximum C^o	Predicted Daily Maximum C^o
Upper Deep Creek	19.7	19.4	28.1	24.8
Castle Creek	19.7	19.4	28.1	25.9
Upper Pole Creek	19.7	19.2	28.1	25.2
Middle Deep Creek	21.4	19.3	27.9	23.7
Red Canyon Creek	15.8	17.9	19.6	23.8
Average	20.1	19.3	28.1	24.9
		Average	Maximum	
Root Mean Square Error		0.5 ^{o}C	1.6^{o}C	
Relative Error		2.6%	5.6%	

Table D2. Validation Results for August 2000.

	Actual Measured Daily Average C^o	Predicted Daily Average C^o	Actual Measured Daily Maximum C^o	Predicted Daily Maximum C^o
Upper Deep Creek	17.9	16.5	24.2	24.1
Castle Creek	18.1	17.2	27.7	25.5
Upper Pole Creek	20.1	17.0	24.3	24.7
Middle Deep Creek	21.4	18.2	25.5	23.3
Average	19.4	17.2	25.4	24.4
		Average	Maximum	
Root Mean Square Error		1.8^{o}C	2.3^{o}C	
Relative Error		9.3%	8.9%	

Examples of SSTEMP Model for Castle Creek

SSTEMP Version 1.2.2

File   View   Help

Hydrology

Segment Inflow (cms)	0.000
Inflow Temperature (°C)	8.300
Segment Outflow (cms)	0.051
Accretion Temp. (°C)	8.300

Geometry

Latitude (radians)	0.733
Dam at Head of Segment	☐
Segment Length (km)	17.703
Upstream Elevation (m)	1800.00
Downstream Elevation (m)	1400.00
Width's A Term (s/m²)	0.900
B Term where W = A*Q**B	0.000
Manning's n	0.035

Meteorology

Air Temperature (°C)	21.800
☑ Maximum Air Temp (°C)	30.300
Relative Humidity (%)	61.210
Wind Speed (mps)	9.000
Ground Temperature (°C)	8.300
Thermal gradient (j/m²/s/C)	1.650
Possible Sun (%)	76.000
Dust Coefficient	6.000
Ground Reflectivity (%)	15.000
Solar Radiation (j/m²/s)	299.395

Shade

Total Shade (%)	2.015

Time of Year

Month/day (mm/dd)	07/15

Intermediate Values

Day Length (hrs) = 14.766
Slope (m/100 m) = 2.260
Width (m) = 1.400
Depth (m) = 0.057
Vegetative Shade (%) = 1.635
Topographic Shade (%) = 0.380

Mean Heat Fluxes at Inflow (j/m²/s)

Convect. = +184.29	Atmos. = +339.87
Conduct. = +0.00	Friction = +0.00
Evapor. = +121.32	Solar = +293.36
Back Rad. = -339.09	Vegetat. = +7.99

Net = +607.75

Optional Shading Parameters

	West Side	East Side
Segment Azimuth (radians)	1.571	
Topographic Altitude (radians)	0.175	0.175
Vegetation Height (m)	3.048	3.048
Vegetative Crown (m)	3.048	3.048
Vegetation Offset (m)	6.096	6.096
Vegetation Density (%)	90.000	90.000

E
—
W

Model Results - Outflow Temperature

Predicted Mean (°C) = 19.35

Estimated Maximum (°C) = 25.89

Approximate Minimum (°C) = 12.81

Mean Equilibrium (°C) = 20.95
Maximum Equilibrium (°C) = 26.17
Minimum Equilibrium (°C) = 15.73

Castle Creek-July   12/19/2002   4:20 PM

SSTEMP Version 1.2.2

File View Help

Hydrology

Segment Inflow (cms)	0.000
Inflow Temperature (°C)	8.300
Segment Outflow (cms)	0.051
Accretion Temp. (°C)	8.300

Geometry

Latitude (radians)	0.733
Dam at Head of Segment	☐
Segment Length (km)	17.703
Upstream Elevation (m)	1800.00
Downstream Elevation (m)	1400.00
Width's A Term (s/m²)	0.900
B Term where W = A*Q**B	0.000
Manning's n	0.035

Meteorology

Air Temperature (°C)	21.800
☑ Maximum Air Temp (°C)	30.300
Relative Humidity (%)	61.210
Wind Speed (mps)	9.000
Ground Temperature (°C)	8.300
Thermal gradient (j/m²/s/C)	1.650
Possible Sun (%)	76.000
Dust Coefficient	6.000
Ground Reflectivity (%)	15.000
Solar Radiation (j/m²/s)	299.395

Shade

Total Shade (%)	75.000

Time of Year

Month/day (mm/dd)	07/15

Intermediate Values

Day Length (hrs) = 14.766

Slope (m/100 m) = 2.260

Width (m) = 0.900

Depth (m) = 0.075

Mean Heat Fluxes at Inflow (j/m²/s)

Convect. = +184.29	Atmos. = +86.71
Conduct. = +0.00	Friction = +0.00
Evapor. = +121.32	Solar = +74.85
Back Rad. = -339.09	Vegetat. = +297.47

- - - - - - - - - - - -

Net = +425.56

Optional Shading Parameters

E/W

	West Side	East Side
Segment Azimuth (radians)	1.571	
Topographic Altitude (radians)	0.175	0.175
Vegetation Height (m)	3.048	3.048
Vegetative Crown (m)	3.048	3.048
Vegetation Offset (m)	6.096	6.096
Vegetation Density (%)	90.000	90.000

Model Results - Outflow Temperature

Predicted Mean (°C) = 15.83

Estimated Maximum (°C) = 20.69

Approximate Minimum (°C) = 10.98

Mean Equilibrium (°C) = 17.75

Maximum Equilibrium (°C) = 21.60

Minimum Equilibrium (°C) = 13.90

Castle Creek-July   12/19/2002   4:23 PM

SSTEMP Version 1.2.2

File   View   Help

Hydrology

Segment Inflow (cms)   0.000
Inflow Temperature (°C)   8.300
Segment Outflow (cms)   0.051
Accretion Temp. (°C)   8.300

Geometry

Latitude (radians)   0.733
Dam at Head of Segment   ☐
Segment Length (km)   17.703
Upstream Elevation (m)   1800.00
Downstream Elevation (m)   1400.00
Width's A Term (s/m²)   0.900
B Term where W = A*Q**B   0.000
Manning's n   0.035

Meteorology

Air Temperature (°C)   21.800
☑ Maximum Air Temp (°C)   30.300
Relative Humidity (%)   61.210
Wind Speed (mps)   9.000
Ground Temperature (°C)   8.300
Thermal gradient (j/m²/s/C)   1.650
Possible Sun (%)   76.000
Dust Coefficient   6.000
Ground Reflectivity (%)   15.000
Solar Radiation (j/m²/s)   299.395

Shade

Total Shade (%)   90.000

Time of Year

Month/day (mm/dd)   07/15

Intermediate Values

Day Length (hrs) = 14.766
Slope (m/100 m) = 2.260
Width (m) = 0.900
Depth (m) = 0.075

Mean Heat Fluxes at Inflow (j/m²/s)

Convect. = +184.29   Atmos. = +34.69
Conduct. = +0.00   Friction = +0.00
Evapor. = +121.32   Solar = +29.94
Back Rad. = -339.09   Vegetat. = +356.97
- - - - - - - - - - - -
Net = +388.12

Optional Shading Parameters

Segment Azimuth (radians)   1.571

                              E
                              W
                      West Side   East Side

Topographic Altitude (radians)   0.175   0.175
Vegetation Height (m)   3.048   3.048
Vegetative Crown (m)   3.048   3.048
Vegetation Offset (m)   6.096   6.096
Vegetation Density (%)   90.000   90.000

Model Results - Outflow Temperature

Predicted Mean (°C) = 15.23
Estimated Maximum (°C) = 19.58
Approximate Minimum (°C) = 10.88

Mean Equilibrium (°C) = 17.04
Maximum Equilibrium (°C) = 20.53
Minimum Equilibrium (°C) = 13.54

Castle Creek-July   12/19/2002   4:23 PM

SSTEMP Version 1.2.2

File   View   Help

Hydrology

Segment Inflow (cms)	0.000
Inflow Temperature (°C)	8.300
Segment Outflow (cms)	0.051
Accretion Temp. (°C)	8.300

Geometry

Latitude (radians)	0.733
Dam at Head of Segment	☐
Segment Length (km)	17.703
Upstream Elevation (m)	1800.00
Downstream Elevation (m)	1400.00
Width's A Term (s/m²)	0.900
B Term where W = A*Q**B	0.000
Manning's n	0.035

Meteorology

Air Temperature (°C)	21.800
☑ Maximum Air Temp (°C)	30.300
Relative Humidity (%)	61.210
Wind Speed (mps)	9.000
Ground Temperature (°C)	8.300
Thermal gradient (j/m²/s/C)	1.650
Possible Sun (%)	76.000
Dust Coefficient	6.000
Ground Reflectivity (%)	15.000
Solar Radiation (j/m²/s)	299.395

Shade

Total Shade (%)	100.000

Time of Year

Month/day (mm/dd)	07/15

Intermediate Values

Day Length (hrs) = 14.766

Slope (m/100 m) = 2.260

Width (m) = 0.900

Depth (m) = 0.075

Mean Heat Fluxes at Inflow (j/m²/s)

Convect. = +184.29	Atmos. = +0.00
Conduct. = +0.00	Friction = +0.00
Evapor. = +121.32	Solar = +0.00
Back Rad. = -339.09	Vegetat. = +396.63

Net = +363.16

Optional Shading Parameters

	West Side	East Side
Segment Azimuth (radians)	1.571	
Topographic Altitude (radians)	0.175	0.175
Vegetation Height (m)	3.048	3.048
Vegetative Crown (m)	3.048	3.048
Vegetation Offset (m)	6.096	6.096
Vegetation Density (%)	90.000	90.000

E/W

Model Results - Outflow Temperature

Predicted Mean (°C) = 14.82

Estimated Maximum (°C) = 18.81

Approximate Minimum (°C) = 10.82

Mean Equilibrium (°C) = 16.55

Maximum Equilibrium (°C) = 19.80

Minimum Equilibrium (°C) = 13.31

Castle Creek-July   12/19/2002   4:24 PM

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SSTEMP (1.2.2) Sensitivity Analysis                                    [X]

Sensitivity for mean temperature values (10% variation)      SSTEMP (1.2.2)
Original mean temperature = 14.82°C
                              Temperature change (°C)
                              if variable is:
Variable                     Decreased Increased   Relative Sensitivity
--------------------------------------------------------------------------------
Segment Inflow (cms)            +0.00     +0.00
Inflow Temperature (°C)          0.00     +0.00
Segment Outflow (cms)           +0.13     -0.14 **
Accretion Temp. (°C)            -0.17     +0.17 ***
Width's A Term (s/m²)           -0.13     +0.15 ***
  B Term where W = A*Q**B       +0.00     +0.00
Manning's n                     +0.00     +0.00
Air Temperature (°C)            -1.64     +1.58 ********************************
Relative Humidity (%)           -0.68     +0.69 **************
Wind Speed (mps)                -0.08     +0.09 **
Ground Temperature (°C)         -0.02     +0.02
Thermal gradient (j/m²/s/C)     +0.02     -0.02
Possible Sun (%)                +0.00     +0.00
Dust Coefficient                +0.00     +0.00
Ground Reflectivity (%)         +0.00     +0.00
Total Shade (%)                 +0.00     -0.41 *******
  Maximum Air Temp (°C)         +0.00     +0.00




      Print                                  View Maxes        Close

Castle Creek-July                            12/19/2002    4:25 PM
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SSTEMP (1.2.2) Sensitivity Analysis                                    [X]

Sensitivity for maximum temperature values (10% varaition)    SSTEMP (1.2.2)
Original maximum temperature = 18.81°C
                                Temperature change (°C)
                                   if variable is:
Variable                        Decreased Increased   Relative Sensitivity
---------------------------------------------------------------------------
Segment Inflow (cms)               +0.00     +0.00
Inflow Temperature (°C)             0.00     +0.00
Segment Outflow (cms)              +0.11     -0.11 ***
Accretion Temp. (°C)               -0.10     +0.10 **
Width's A Term (s/m²)              -0.11     +0.13 ***
  B Term where W = A*Q**B          +0.00     +0.00
Manning's n                        +0.04     -0.04 *
Air Temperature (°C)               -0.68     +0.64 ***************
Relative Humidity (%)              -0.67     +0.69 ****************
Wind Speed (mps)                   -0.05     +0.06 *
Ground Temperature (°C)            -0.02     +0.02
Thermal gradient (j/m²/s/C)        +0.03     -0.03 *
Possible Sun (%)                   +0.00     +0.00
Dust Coefficient                   +0.00     +0.00
Ground Reflectivity (%)            +0.00     +0.00
Total Shade (%)                    +0.00     -0.76 ******************
 Maximum Air Temp (°C)             -1.27     +1.35 *******************************
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| Castle Creek-July | | 12/19/2002 | 4:26 PM |

Table D3.

Stream Name Rosgen Channel Type	Target Temperature	Model Run Dates	Segment Length (mi.)	Solar Radiation Components 24 hours (+/-) (joules/m^2/sec)	% Total Shade	% Topo Shade	% Veg Shade	Width/ Depth Ratio	Temperature (24 hours)	^{o}C
Mid-Pole-Cowboy Creeks to Deep Creek F	13°C Max 9°C Avg.	June 1 through June 30	8.2	+122.43	34.4	34.4	0.0	32.1	Minimum Mean Maximum	10.7 14.4 18.1
				+126.77	34.4	34.4	0.0	11.8	Minimum Mean Maximum	9.8 13.5 17.3
				+88.84	50.0	34.4	15.4	11.8	Minimum Mean Maximum	9.8 13.0 16.1
				+22.64	75.0	34.4	35.6	11.8	Minimum Mean Maximum	10.0 12.1 14.1
				-15.89	90.0	34.4	55.6	11.8	Minimum Mean Maximum	10.0 11.5 12.9
				-41.57	100.0	34.4	65.6	11.8	Minimum Mean Maximum	10.1 11.1 12.1
Bull Gulch B, G and F	13°C Max 9°C Avg.	June 1 through June 30	14.5	+402.09	7.7	0.9	6.8	24.4	Minimum Mean Maximum	11.7 16.2 20.1
				+416.55	2.3	0.4	1.9	10.9	Minimum Mean Maximum	10.9 15.9 20.9
				+293.98	50.0	0.4	49.6	10.9	Minimum Mean Maximum	10.6 13.8 17.1
				+229.73	75.0	0.4	74.6	10.9	Minimum Mean Maximum	10.5 12.7 14.9
				+191.18	90.0	0.4	89.6	10.9	Minimum Mean Maximum	10.5 12.0 13.5
				+165.48	100	0.4	99.6	10.9	Minimum Mean Maximum	10.4 11.5 12.6

Table D4.

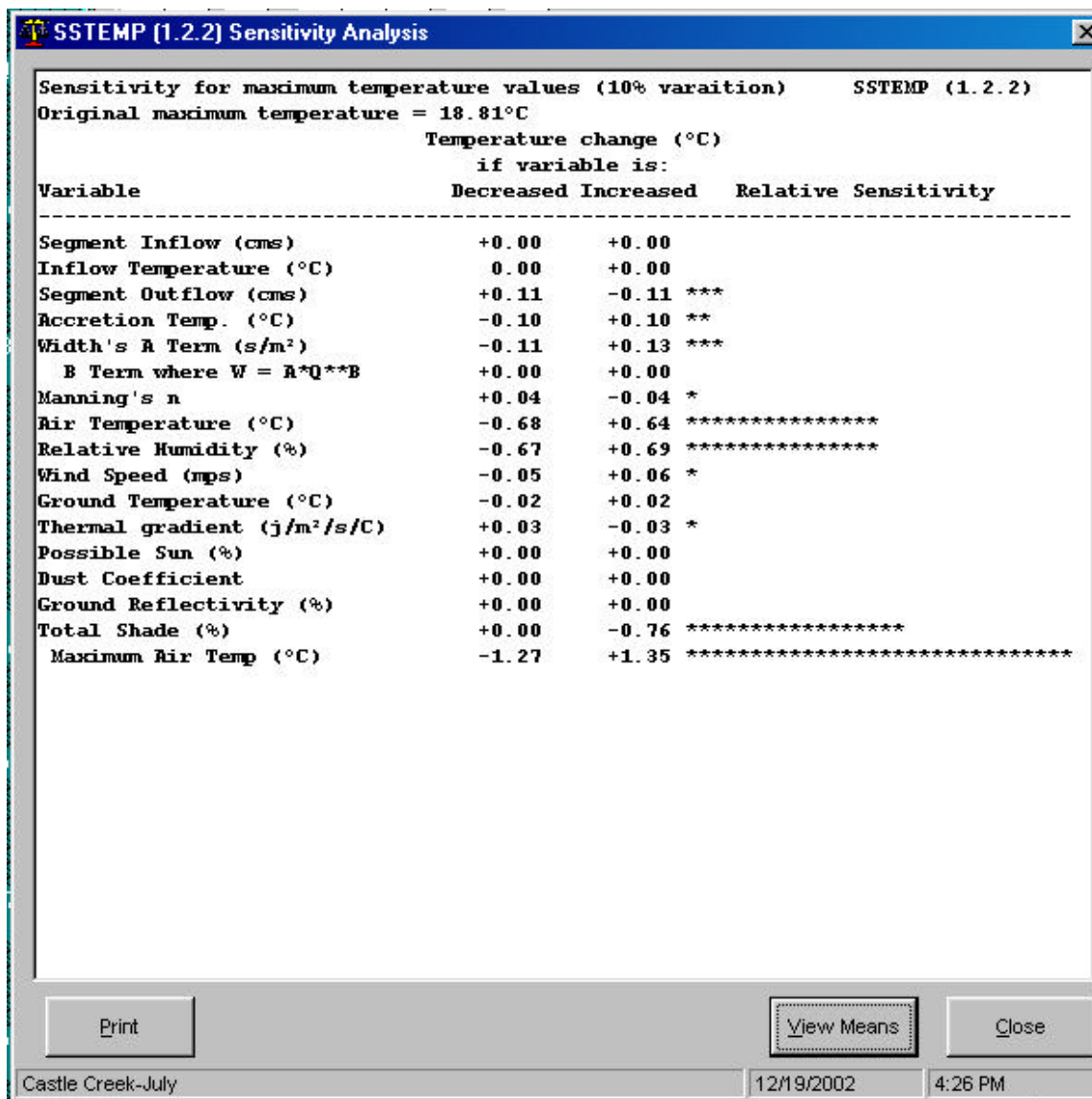| Stream Name Rosgen Channel Type	Target Temperature	Model Run Dates	Segment Length (mi.)	Solar Radiation Components 24 hours (+/-) (joules/m²/sec)	% Total Shade	% Topo Shade	% Veg Shade	Width/ Depth Ratio	Temperature (24 hours)	°C
Red Canyon Creek A, B and F	13°C Max 9°C Avg.	June 1 through June 30	13.2	+360.52	23.7	20.8	2.9	25.4	Minimum Mean Maximum	8.6 13.1 17.6
				+358.32	24.6	20.8	3.8	11.8	Minimum Mean Maximum	7.8 12.1 16.4
				+292.97	50.0	20.8	29.2	11.8	Minimum Mean Maximum	8.2 11.4 14.7
				+228.64	75.0	20.8	54.2	11.8	Minimum Mean Maximum	8.6 10.7 12.8
				+190.05	90.0	20.8	69.2	11.8	Minimum Mean Maximum	8.9 10.3 11.7
				+164.32	100.0	20.8	79.2	11.8	Minimum Mean Maximum	9.1 10.0 11.0
Lower Deep Creek F	13°C Max 9°C Avg.	June 1 through June 30	8.4	+129.12	34.4	34.4	0.0	104.0	Minimum Mean Maximum	13.0 15.7 18.4
				+89.3	50.0	34.4	15.6	104.0	Minimum Mean Maximum	12.7 14.9 17.2
				+25.31	75.0	34.4	40.6	104.0	Minimum Mean Maximum	12.1 13.7 15.2
				-13.11	90.0	34.4	55.6	104.0	Minimum Mean Maximum	11.8 12.9 14.0
				-38.72	100.0	34.4	65.6	104.0	Minimum Mean Maximum	11.6 12.4 13.1

Table D5.

Stream Name Rosgen Channel Type	Target Temperature	Model Run Dates	Segment Length (mi.)	Solar Radiation Components 24 hours (+/-) (joules/m²/sec)	% Total Shade	% Topo Shade	% Veg Shade	Width/ Depth Ratio	Temperature (24 hours)	ºC
Upper Dickshooter Creek G, F	13ºC Max 9ºC Avg.	June 1 through June 30	11.7	+277.12	2.3	0.4	1.9	30.3	Minimum Mean Maximum	10.5 14.8 19.1
				+279.06	2.3	0.4	1.9	13.3	Minimum Mean Maximum	10.5 14.8 19.2
				+156.69	50.0	0.4	49.6	13.3	Minimum Mean Maximum	9.2 12.2 15.1
				+92.54	75.0	0.4	74.6	13.3	Minimum Mean Maximum	8.6 10.6 12.7
				+54.05	90.0	0.4	89.6	13.3	Minimum Mean Maximum	8.2 9.7 11.1
				+28.39	100.0	0.4	99.6	13.3	Minimum Mean Maximum	8.0 9.0 10.0
Lower Dickshooter Creek F	13ºC Max 9ºC Avg.	June 1 through June 30	13.0	+53.93	33.6	33.6	0.0	22.8	Minimum Mean Maximum	7.1 12.4 17.6
				+54.56	33.6	33.6	0.0	11.9	Minimum Mean Maximum	6.7 11.7 16.7
				+12.46	50.0	33.6	16.4	11.9	Minimum Mean Maximum	7.0 11.0 14.9
				-51.76	75.0	33.6	38.4	11.9	Minimum Mean Maximum	7.5 9.8 12.2
				-90.28	90.0	33.6	53.4	11.9	Minimum Mean Maximum	7.7 10.6 9.2
				-115.97	100.0	33.6	66.4	11.9	Minimum Mean Maximum	7.9 8.7 9.6

Table D6.

Stream Name Rosgen Channel Type	Target Temperature	Model Run Dates	Segment Length (mi.)	Solar Radiation Components 24 hours (+/-) (joules/m^2/sec)	% Total Shade	% Topo Shade	% Veg Shade	Width/ Depth Ratio	Temperature (24 hours)	^{o}C
Beaver Creek A, B & G	13°C Max 9°C Avg.	June 1 through June 30	8.7	+273.40	2.6	0.9	1.7	24.2	Minimum Mean Maximum	7.8 13.1 18.3
				+273.36	2.6	0.9	1.7	11.4	Minimum Mean Maximum	7.1 12.4 17.8
				+151.68	50.0	0.9	49.1	11.4	Minimum Mean Maximum	7.3 10.6 13.9
				+87.51	75.0	0.9	74.1	11.4	Minimum Mean Maximum	7.5 9.6 11.8
				+49.00	90.0	0.9	89.1	11.4	Minimum Mean Maximum	7.6 9.1 10.5
				+23.33	100.0	0.9	99.1	11.4	Minimum Mean Maximum	7.7 8.7 9.7

Table D7.

Stream Name Rosgen Channel Type	Target Temperature	Model Run Dates	Segment Length (mi.)	Solar Radiation Components 24 hours (+/-) (joules/m^2/sec)	% Total Shade	% Topo Shade	% Veg Shade	Width/ Depth Ratio	Temperature (24 hours)	^{o}C
Mid-Pole-Cowboy Creeks to Deep Creek F	13°C Max 9°C Avg.	June 1 through June 30	8.2	+141.67	34.4	34.4	0.0	27.6	Minimum Mean Maximum	8.7 12.3 16.0
				+144.85	34.4	34.4	0.0	11.6	Minimum Mean Maximum	8.4 11.9 15.5
				+104.96	50.0	34.4	15.6	11.6	Minimum Mean Maximum	8.3 11.2 14.2
				+40.87	75.0	34.4	40.6	11.6	Minimum Mean Maximum	8.2 10.1 12.1
				+2.42	90.0	34.4	55.6	11.6	Minimum Mean Maximum	8.1 9.4 10.8
				-23.22	100.0	34.4	65.6	11.6	Minimum Mean Maximum	8.1 9.0 9.9
Bull Gulch B, G and F	13°C Max 9°C Avg.	June 1 through June 30	14.5	+191.66	34.4	34.4	0.0	24.3	Minimum Mean Maximum	8.5 12.3 16.2
				+191.66	34.4	34.4	0.0	14.0	Minimum Mean Maximum	8.2 12.1 16.0
				+151.71	50.0	34.4	15.6	14.0	Minimum Mean Maximum	8.1 11.3 14.6
				+87.54	75.0	34.4	40.6	14.0	Minimum Mean Maximum	7.9 10.1 12.3
				+49.04	90.0	34.4	55.6	14.0	Minimum Mean Maximum	7.8 9.3 10.8
				+23.37	100.0	34.4	65.6	14.0	Minimum Mean Maximum	7.8 8.8 9.8

Table D8.

Stream Name Rosgen Channel Type	Target Temperature	Model Run Dates	Segment Length (mi.)	Solar Radiation Components 24 hours (+/-) (joules/m²/sec)	% Total Shade	% Topo Shade	% Veg Shade	Width/ Depth Ratio	Temperature (24 hours)	ºC
Mid-Pole Creek to Deep Creek F	13ºC Max 9ºC Avg.	June 1 through June 30	10.3	+195.36	14.5	11.2	3.3	28.1	Minimum Mean Maximum	10.1 14.1 18.1
				+195.84	16.1	11.2	4.8	12.7	Minimum Mean Maximum	9.8 13.8 17.8
				+108.82	50.0	11.2	38.8	12.7	Minimum Mean Maximum	9.2 12.0 14.9
				+44.73	75.0	11.2	63.8	11.7	Minimum Mean Maximum	8.7 10.7 12.6
				+6.28	90.0	11.2	78.8	11.7	Minimum Mean Maximum	8.5 9.8 11.2
				-19.36	100.0	11.2	88.8	11.7	Minimum Mean Maximum	8.4 9.3 10.2
Castle Creek A, B, C and G	13ºC Max 9ºC Avg.	June 1 through June 30	11.0	+274.04	2.4	1.4	1.0	25.4	Minimum Mean Maximum	8.0 13.1 18.2
				+272.50	2.6	1.4	1.2	12.9	Minimum Mean Maximum	7.4 12.5 17.6
				+151.83	50.0	1.4	48.6	12.9	Minimum Mean Maximum	7.5 10.7 13.8
				+87.68	75.0	1.4	73.6	12.9	Minimum Mean Maximum	7.6 9.7 11.7
				+49.19	90.0	1.4	88.6	12.9	Minimum Mean Maximum	7.7 9.1 10.5
				+23.53	100.0	1.4	98.6	12.9	Minimum Mean Maximum	7.7 8.7 9.6

Table D9.

Stream Name Rosgen Channel Type	Target Temperature	Model Run Dates	Segment Length (mi.)	Solar Radiation Components 24 hours (+/-) (joules/m^2/sec)	% Total Shade	% Topo Shade	% Veg Shade	Width/ Depth Ratio	Temperature (24 hours)	°C
Hurry Back A, B and C	13°C Max 9°C Avg.	June 1 through June 30	11.2	+246.21	12.6	7.1	5.5	28.4	Minimum Mean Maximum	7.5 12.2 16.9
				+241.25	14.5	7.1	7.4	12.2	Minimum Mean Maximum	7.0 11.4 15.8
				+150.16	50.0	7.1	42.9	12.2	Minimum Mean Maximum	7.3 10.2 13.2
				+85.90	75.0	7.1	67.9	12.2	Minimum Mean Maximum	7.5 9.4 11.3
				+47.35	90.0	7.1	82.1	12.2	Minimum Mean Maximum	7.6 8.9 10.2
				+21.64	100.0	7.1	92.1	12.2	Minimum Mean Maximum	7.7 8.6 9.5
Nip and Tuck Creek A, B and C	13°C Max 9°C Avg.	June 1 through June 30	6.8	+242.46	14.1	7.1	7.0	22.9	Minimum Mean Maximum	6.5 11.5 16.5
				+239.20	15.4	7.1	8.3	11.8	Minimum Mean Maximum	6.0 10.8 15.7
				+150.23	50.0	7.1	42.9	11.8	Minimum Mean Maximum	6.7 9.9 13.1
				+85.89	75.0	7.1	67.9	11.8	Minimum Mean Maximum	7.2 9.2 11.3
				+47.42	90.0	7.1	82.9	11.8	Minimum Mean Maximum	7.4 8.8 10.2
				+21.72	100.0	7.1	92.9	11.8	Minimum Mean Maximum	7.6 8.5 9.5

Table D10.

Stream Name Rosgen Channel Type	Target Temperature	Model Run Dates	Segment Length (mi.)	Solar Radiation Components 24 hours (+/-) (joules/m^2/sec)	% Total Shade	% Topo Shade	% Veg Shade	Width/ Depth Ratio	Temperature (24 hours)	^{o}C
Deep Creek to Current Cr. F	13°C Max 9°C Avg.	June 1 through June 30	5	+147.99	34.4	34.4	0.0	22.9	Minimum Mean Maximum	8.2 11.0 13.7
				+149.59	34.4	34.4	0.0	12.9	Minimum Mean Maximum	8.2 10.6 13.1
				+109.77	50.0	34.4	15.6	12.9	Minimum Mean Maximum	8.3 10.3 12.3
				+45.69	75.0	34.4	40.6	12.9	Minimum Mean Maximum	8.6 9.9 11.1
				+7.24	90.0	34.4	55.6	`12.9	Minimum Mean Maximum	8.7 9.6 10.4
				-18.40	100.0	34.4	65.6	12.9	Minimum Mean Maximum	8.8 9.4 9.9
Current Creek A, B and C	13°C Max 9°C Avg.	June 1 through June 30	13.5	+191.13	34.4	34.4	0.0	25.8	Minimum Mean Maximum	7.7 11.3 14.9
				+191.13	34.4	34.4	0.0	11.8	Minimum Mean Maximum	7.4 10.8 14.2
				+151.13	50.0	34.4	15.6	11.8	Minimum Mean Maximum	7.5 10.3 13.1
				+86.88	75.0	34.4	40.6	11.8	Minimum Mean Maximum	7.7 9.4 11.2
				+48.32	90.0	34.4	55.6	11.8	Minimum Mean Maximum	7.7 8.9 10.1
				+22.62	100.0	34.4	65.6	11.8	Minimum Mean Maximum	7.8 8.6 9.4

Table D11.

Stream Name Rosgen Channel Type	Target Temperature	Model Run Dates	Segment Length (mi.)	Solar Radiation Components 24 hours (+/-) (joules/m²/sec)	% Total Shade	% Topo Shade	% Veg Shade	Width/ Depth Ratio	Temperature (24 hours)	°C
Red Canyon Creek A, B and F	13°C Max 9°C Avg.	June 1 through June 30	13.2	+191.21	34.4	34.4	0.0	24.2	Minimum Mean Maximum	7.7 11.5 15.3
				+191.21	34.4	34.4	0.0	14.9	Minimum Mean Maximum	7.4 11.2 15.0
				+151.22	50.0	34.4	15.6	14.9	Minimum Mean Maximum	7.5 10.6 13.7
				+86.89	75.0	34.4	40.6	14.9	Minimum Mean Maximum	7.6 9.6 11.7
				+48.44	90.0	34.4	55.6	14.9	Minimum Mean Maximum	7.7 9.0 10.4
				+22.74	100.0	34.4	65.6	14.9	Minimum Mean Maximum	7.7 8.7 9.6
Lower Deep Creek F	13°C Max 9°C Avg.	June 1 through June 30	8.4	+148.57	34.4	34.4	0.0	100	Minimum Mean Maximum	8.8 11.9 15.0
				+108.76	50.0	34.4	15.6	100	Minimum Mean Maximum	8.7 11.2 13.8
				+44.80	75.0	34.4	40.6	100	Minimum Mean Maximum	8.5 10.1 11.8
				+6.42	90.0	34.4	55.6	100	Minimum Mean Maximum	8.3 9.5 10.6
				-19.16	100.0	34.4	65.6	100	Minimum Mean Maximum	8.2 9.0 9.8

Table D12.

Stream Name Rosgen Channel Type	Target Temperature	Model Run Dates	Segment Length (mi.)	Solar Radiation Components 24 hours (+/-) (joules/m^2/sec)	% Total Shade	% Topo Shade	% Veg Shade	Width/ Depth Ratio	Temperature (24 hours)	^{o}C
Middle Deep Creek Nickel Cr. To Pole Creek F	13°C Max 9°C Avg.	June 1 through June 30	5	+159.46	34.4	34.4	0.0	27.0	Minimum Mean Maximum	7.8 10.6 13.4
				+162.95	34.4	34.4	0.0	12.8	Minimum Mean Maximum	7.7 10.2 12.6
				+123.10	50.0	34.4	15.6	12.8	Minimum Mean Maximum	8.0 9.9 11.9
				+59.09	75.0	34.4	55.6	12.8	Minimum Mean Maximum	8.3 9.6 10.8
				+20.69	90.0	34.4	65.6	12.8	Minimum Mean Maximum	8.5 9.3 10.1
				-4.92	100.0	34.4	75.6	12.8	Minimum Mean Maximum	8.6 9.2 9.7
Nickel Creek A, B, C and F	13°C Max 9°C Avg.	June 1 through June 30	9.7	+190.91	34.4	34.4	0.0	29.1	Minimum Mean Maximum	7.3 11.3 15.3
				+190.91	34.4	34.4	0.0	11.5	Minimum Mean Maximum	6.8 10.6 14.5
				+150.89	50.0	34.4	15.6	11.5	Minimum Mean Maximum	7.0 10.1 13.3
				+86.60	75.0	34.4	40.6	11.5	Minimum Mean Maximum	7.3 9.4 11.4
				+48.02	90.0	34.4	55.6	11.5	Minimum Mean Maximum	7.5 8.9 10.3
				+22.31	100.0	34.4	65.6	11.5	Minimum Mean Maximum	7.7 8.6 9.5

Table D13.

Stream Name Rosgen Channel Type	Target Temperature	Model Run Dates	Segment Length (mi.)	Solar Radiation Components 24 hours (+/-) (joules/m²/sec)	% Total Shade	% Topo Shade	% Veg Shade	Width/ Depth Ratio	Temperature (24 hours)	°C
Middle Deep, Current Creek to Nickel Creek F	13°C Max 9°C Avg.	June 1 through June 30	15.8	+162.92	34.4	34.4	0.0	24.9	Minimum Mean Maximum	9.4 12.1 14.8
				+166.17	34.4	34.4	0.0	13.0	Minimum Mean Maximum	9.2 11.6 14.0
				+126.39	50.0	34.4	15.6	13.0	Minimum Mean Maximum	9.0 11.0 13.0
				+62.36	75.0	34.4	40.6	13.0	Minimum Mean Maximum	8.8 10.1 11.4
				+23.94	90.0	34.4	55.6	13.0	Minimum Mean Maximum	8.6 9.5 10.4
				-1.67	100.0	34.4	65.6	13.0	Minimum Mean Maximum	8.5 9.1 9.7
Upper Pole Creek A, B, C and F	13°C Max 9°C Avg.	June 1 through June 30	6.8	+241.67	14.7	1.7	13.0	22.4	Minimum Mean Maximum	8.5 13.1 17.6
				+238.59	15.9	1.7	14.2	11.5	Minimum Mean Maximum	8.1 12.6 17.2
				+150.83	50.0	1.7	48.3	11.5	Minimum Mean Maximum	7.9 11.1 14.2
				+86.53	75.0	1.7	73.3	11.5	Minimum Mean Maximum	7.8 9.9 12.0
				+47.95	90.0	1.7	88.3	11.5	Minimum Mean Maximum	7.8 9.2 10.6
				+22.24	100.0	1.7	98.3	11.5	Minimum Mean Maximum	7.8 8.7 9.7

Table D14.

Stream Name Rosgen Channel Type	Target Temperature	Model Run Dates	Segment Length (mi.)	Solar Radiation Components 24 hours (+/-) (joules/m^2/sec)	% Total Shade	% Topo Shade	% Veg Shade	Width/ Depth Ratio	Temperature (24 hours)	ºC
Nip and Tuck A, B and G	22ºC Max 19ºC Avg.	July 1 through July 31	6.8	+568.79	16.1	11.5	4.6	25.4	Minimum Mean Maximum	10.4 17.6 24.7
				+566.01	17.2	11.5	5.7	13.3	Minimum Mean Maximum	9.0 16.6 24.1
				+483.94	50.0	11.5	38.5	13.3	Minimum Mean Maximum	9.0 15.4 21.9
				+421.43	75.0	11.5	63.5	13.3	Minimum Mean Maximum	9.1 14.6 20.1
				+383.92	90.0	11.5	73.5	13.3	Minimum Mean Maximum	9.2 14.0 18.9
				+358.92	100.0	11.5	88.5	13.3	Minimum Mean Maximum	9.2 13.7 18.1
Current-Stoneman Creeks A, B, C and F	22ºC Max 19ºC Avg.	July 1 through July 31	8.9	+523.40	34.9	34.9	0.0	25.3	Minimum Mean Maximum	12.0 17.8 23.5
				+523.40	34.9	34.9	0.0	14.2	Minimum Mean Maximum	11.2 17.2 23.1
				+485.58	50.0	34.9	15.1	14.2	Minimum Mean Maximum	11.1 16.7 22.1
				+423.07	75.0	34.9	40.1	14.2	Minimum Mean Maximum	10.9 15.6 20.3
				+385.56	90.0	34.9	55.1	14.2	Minimum Mean Maximum	10.8 15.0 19.2
				+360.55	100.0	34.9	65.1	14.2	Minimum Mean Maximum	10.8 14.6 18.5

Table D15.

Stream Name Rosgen Channel Type	Target Temperature	Model Run Dates	Segment Length (mi.)	Solar Radiation Components 24 hours (+/-) (joules/m²/sec)	% Total Shade	% Topo Shade	% Veg Shade	Width/ Depth Ratio	Temperature (24 hours)	°C
Nickel Creek A, B, G and F	22°C Max 19°C Avg.	July 1 through July 31	9.7	+520.37	34.9	34.9	0.0	23.3	Minimum Mean Maximum	11.0 17.3 23.6
				+520.37	34.9	34.9	0.0	13.7	Minimum Mean Maximum	10.2 16.7 23.2
				+482.53	50.0	34.9	15.1	13.7	Minimum Mean Maximum	10.1 16.1 22.2
				+419.98	75.0	34.9	40.1	13.7	Minimum Mean Maximum	10.0 15.2 20.4
				+382.45	90.0	34.9	55.1	13.7	Minimum Mean Maximum	10.0 14.6 19.3
				+357.43	100.0	34.9	65.1	13.7	Minimum Mean Maximum	10.0 14.2 18.5
Upper Pole Creek B, C and G	22°C Max 19°C Avg.	July 1 through July 31	6.8	+566.77	16.3	1.8	14.5	26.0	Minimum Mean Maximum	13.2 19.2 25.2
				+564.48	17.2	1.8	15.4	11.9	Minimum Mean Maximum	12.3 18.6 24.8
				+482.33	50.0	1.8	48.2	11.9	Minimum Mean Maximum	11.8 17.2 22.7
				+419.78	75.0	1.8	73.2	11.9	Minimum Mean Maximum	11.5 16.2 20.9
				+382.25	90.0	1.8	88.2	11.9	Minimum Mean Maximum	11.4 15.6 19.8
				+357.22	100.0	1.8	98.2	11.9	Minimum Mean Maximum	11.3 15.1 19.0

Table D16.

Stream Name Rosgen Channel Type	Target Temperature	Model Run Dates	Segment Length (mi.)	Solar Radiation Components 24 hours (+/-) (joules/m^2/sec)	% Total Shade	% Topo Shade	% Veg Shade	Width/ Depth Ratio	Temperature (24 hours)	°C
Camas Creek B, C and G	22°C Max 19°C Avg.	Ju1y 1 through July 31	8.9	+588.57	8.5	0.9	7.6	26.0	Minimum Mean Maximum	13.4 19.6 25.8
				+587.65	8.9	0.9	8.0	15.1	Minimum Mean Maximum	12.7 19.2 25.7
				+484.87	50.0	0.9	49.9	15.1	Minimum Mean Maximum	12.0 17.6 23.1
				+422.33	75.0	0.9	74.1	15.1	Minimum Mean Maximum	11.7 16.5 21.4
				+384.80	90.0	0.9	89.1	15.1	Minimum Mean Maximum	11.5 15.9 20.2
				+359.76	100.0	0.9	99.1	15.1	Minimum Mean Maximum	11.4 15.4 19.5
Camel Creek A, B, C and G	22°C Max 19°C Avg.	July 1 through July 31		+567.07	16.6	7.3	9.3	24.3	Minimum Mean Maximum	13.9 19.5 25.2
				+565.91	17.1	7.3	9.8	12.3	Minimum Mean Maximum	13.3 19.2 25.1
				+483.66	50.0	7.3	42.7	12.3	Minimum Mean Maximum	12.7 17.8 22.9
				+421.17	75.0	7.3	64.7	12.3	Minimum Mean Maximum	12.3 16.7 21.2
				+383.67	90.0	7.3	82.7	12.3	Minimum Mean Maximum	12.1 16.1 20.1
				+358.67	100.0	7.3	92.7	12.3	Minimum Mean Maximum	11.9 15.6 19.3

Table D17.

Stream Name Rosgen Channel Type	Target Temperature	Model Run Dates	Segment Length (mi.)	Solar Radiation Components 24 hours (+/-) (joules/m²/sec)	% Total Shade	% Topo Shade	% Veg Shade	Width/ Depth Ratio	Temperature (24 hours)	ºC
Castle Creek A, B, C and G	22ºC Max 19ºC Avg.	Ju1y 1 through July 31	11.0	+607.76	2.0	0.4	1.6	24.5	Minimum Mean Maximum	12.8 19.4 25.9
				+607.57	2.1	0.4	1.7	12.0	Minimum Mean Maximum	11.7 18.6 25.5
				+487.97	50.0	0.4	49.6	12.0	Minimum Mean Maximum	11.2 16.8 22.5
				+425.56	75.0	0.4	74.6	12.0	Minimum Mean Maximum	11.0 15.8 20.7
				+388.12	90.0	0.4	89.6	12.0	Minimum Mean Maximum	10.9 15.2 19.6
				+363.16	100.0	0.4	99.6	12.0	Minimum Mean Maximum	10.8 14.8 18.8
Beaver Creek B, C and G	22ºC Max 19ºC Avg.	July 1 through July 31	8.7	+607.14	2.1	0.4	1.7	26.1	Minimum Mean Maximum	12.6 19.3 26.0
				+607.10	2.1	0.4	1.7	11.1	Minimum Mean Maximum	11.1 18.4 25.6
				+487.45	50.0	0.4	49.6	11.1	Minimum Mean Maximum	10.7 16.6 22.5
				+425.02	75.0	0.4	74.6	11.1	Minimum Mean Maximum	10.5 15.6 20.8
				+387.56	90.0	0.4	89.6	11.1	Minimum Mean Maximum	10.5 15.0 19.6
				+362.59	100.0	0.4	99.6	11.1	Minimum Mean Maximum	10.4 11.6 18.8

Table D18.

Stream Name Rosgen Channel Type	Target Temperature	Model Run Dates	Segment Length (mi.)	Solar Radiation Components 24 hours (+/-) (joules/m^2/sec)	% Total Shade	% Topo Shade	% Veg Shade	Width/ Depth Ratio	Temperature (24 hours)	°C
Bull Gulch B and F	22°C Max 19°C Avg.	July 1 through July 31	14.5	+525.24	34.9	34.9	0.0	23.5	Minimum Mean Maximum	13.1 18.6 24.1
				+525.24	34.9	34.9	0.0	11.1	Minimum Mean Maximum	12.3 18.1 24.0
				+487.55	50.0	34.9	15.1	11.1	Minimum Mean Maximum	12.1 17.5 23.0
				+425.13	75.0	34.9	40.1	11.1	Minimum Mean Maximum	11.7 16.5 21.2
				+387.67	90.0	34.9	55.1	11.1	Minimum Mean Maximum	11.5 15.8 20.1
				+362.70	100.0	34.9	65.1	11.1	Minimum Mean Maximum	11.4 15.4 19.4
Upper Dickshooter Creek B and C	22°C Max 19°C Avg.	July 1 through July 31		+591.40	8.6	3.5	5.0	22.2	Minimum Mean Maximum	14.1 19.9 25.8
				+591.20	8.6	3.5	5.1	13.9	Minimum Mean Maximum	13.8 19.7 25.7
				+487.97	50.0	3.5	46.5	13.9	Minimum Mean Maximum	12.9 18.0 23.1
				+425.56	75.0	3.5	71.5	13.9	Minimum Mean Maximum	12.5 16.9 21.4
				+388.12	90.0	3.5	86.5	13.9	Minimum Mean Maximum	12.3 16.3 20.3
				+363.16	100.0	3.5	96.5	13.9	Minimum Mean Maximum	12.1 15.8 19.5

Table D19.

Stream Name Rosgen Channel Type	Target Temperature	Model Run Dates	Segment Length (mi.)	Solar Radiation Components 24 hours (+/-) (joules/m^2/sec)	% Total Shade	% Topo Shade	% Veg Shade	Width/ Depth Ratio	Temperature (24 hours)	^{o}C
Bull Gulch B and F	22°C Max 19°C Avg.	July 1 through July 31	14.5	+525.24	34.9	34.9	0.0	23.5	Minimum Mean Maximum	13.1 18.6 24.1
				+525.24	34.9	34.9	0.0	11.1	Minimum Mean Maximum	12.3 18.1 24.0
				+487.55	50.0	34.9	15.1	11.1	Minimum Mean Maximum	12.1 17.5 23.0
				+425.13	75.0	34.9	40.1	11.1	Minimum Mean Maximum	11.7 16.5 21.2
				+387.67	90.0	34.9	55.1	11.1	Minimum Mean Maximum	11.5 15.8 20.1
				+362.70	100.0	34.9	65.1	11.1	Minimum Mean Maximum	11.4 15.4 19.4
Upper Dickshooter Creek B and C	22°C Max 19°C Avg.	July 1 through July 31		+591.40	8.6	3.5	5.0	22.2	Minimum Mean Maximum	14.1 19.9 25.8
				+591.20	8.6	3.5	5.1	13.9	Minimum Mean Maximum	13.8 19.7 25.7
				+487.97	50.0	3.5	46.5	13.9	Minimum Mean Maximum	12.9 18.0 23.1
				+425.56	75.0	3.5	71.5	13.9	Minimum Mean Maximum	12.5 16.9 21.4
				+388.12	90.0	3.5	86.5	13.9	Minimum Mean Maximum	12.3 16.3 20.3
				+363.16	100.0	3.5	96.5	13.9	Minimum Mean Maximum	12.1 15.8 19.5

Table D20.

Stream Name Rosgen Channel Type	Target Temperature	Model Run Dates	Segment Length (mi.)	Solar Radiation Components 24 hours (+/-) (joules/m²/sec)	% Total Shade	% Topo Shade	% Veg Shade	Width/ Depth Ratio	Temperature (24 hours)	°C
Deep Creek, Hurry Back to Current Creek G and F	22°C Max 19°C Avg.	July 1 through July 31	5	+11.36	34.9	34.9	0.0	24.0	Minimum	14.7
									Mean	19.3
									Maximum	23.9
Model Run does not Show Water Temperature Reductions Upstream				+24.83	34.9	34.9	0.0	12.3	Minimum	14.6
									Mean	19.1
									Maximum	23.6
				+15.93	50.0	34.9	15.1	12.3	Minimum	14.5
									Mean	22.7
									Maximum	18.6
				+0.46	75.0	34.9	40.1	12.3	Minimum	14.2
									Mean	17.8
									Maximum	21.2
				-9.26	90.0	34.9	55.1	12.3	Minimum	14.2
									Mean	17.2
									Maximum	20.3
				-15.92	100	34.9	65.1	12.3	Minimum	14.1
									Mean	16.9
									Maximum	19.7
Deep Creek, Hurry Back to Current Creek G and F	22°C Max 19°C Avg.	July 1 through July 31	5						Minimum	15.2
									Mean	19.8
									Maximum	24.2
Model Run Shows Water Temperature Reduction Achieved Upstream									Minimum	15.8
									Mean	19.9
									Maximum	24.1
									Minimum	15.6
									Mean	19.4
									Maximum	23.3
									Minimum	15.4
									Mean	18.6
									Maximum	21.8
									Minimum	15.3
									Mean	18.1
									Maximum	21.0
									Minimum	15.2
									Mean	17.8
									Maximum	20.4

Table D21.

Stream Name Rosgen Channel Type	Target Temperature	Model Run Dates	Segment Length (mi.)	Solar Radiation Components 24 hours (+/-) (joules/m^2/sec)	% Total Shade	% Topo Shade	% Veg Shade	Width/ Depth Ratio	Temperature (24 hours)	°C
Red Canyon Creek A, B and F	22°C Max 19°C Avg.	July 1 through July 31	13.2	+523.71	34.9	34.9	0.0	24.1	Minimum Mean Maximum	12.0 17.9 23.8
				+523.71	34.9	34.9	0.0	12.6	Minimum Mean Maximum	11.1 17.2 23.4
				+485.90	50.0	34.9	15.1	12.6	Minimum Mean Maximum	11.0 16.6 22.3
				+423.40	75.0	34.9	40.1	12.6	Minimum Mean Maximum	10.8 15.7 20.6
				+385.90	90.0	34.9	55.1	12.6	Minimum Mean Maximum	10.7 15.1 19.4
				+360.90	100.0	34.9	65.1	12.6	Minimum Mean Maximum	10.7 11.7 18.7

Table D22.

Stream Name Rosgen Channel Type	Target Temperature	Model Run Dates	Segment Length (mi.)	Solar Radiation Components 24 hours (+/-) (joules/m^2/sec)	% Total Shade	% Topo Shade	% Veg Shade	Width/ Depth Ratio	Temperature (24 hours)	°C
Camel Creek A, B and G	13°C Max 9°C Avg.	June 1 through June 30	4.0	+237.91	16.3	11.2	5.1	26.6	Minimum Mean Maximum	7.9 12.7 17.5
				+233.74	17.9	11.2	6.7	11.9	Minimum Mean Maximum	8.0 12.8 17.5
				+151.22	50.0	11.2	38.8	11.9	Minimum Mean Maximum	7.9 11.2 14.6
				+86.89	75.0	11.2	63.8	11.9	Minimum Mean Maximum	7.8 10.0 12.3
				+48.44	90.0	11.2	78.8	11.9	Minimum Mean Maximum	7.7 9.3 10.8
				+22.74	100.0	11.2	88.8	11.9	Minimum Mean Maximum	7.7 8.8 9.8
Camas Creek A, B and G	13°C Max 9°C Avg.	June 1 through June 30	8.9	+260.69	7.3	0.9	6.4	23.6	Minimum Mean Maximum	9.2 13.8 18.5
				+259.21	7.9	0.9	7.0	13.2	Minimum Mean Maximum	8.9 13.6 18.2
				+150.92	50.0	0.9	49.1	13.2	Minimum Mean Maximum	8.3 11.5 14.6
				+86.64	75.0	0.9	74.1	13.2	Minimum Mean Maximum	8.0 10.2 12.2
				+48.07	90.0	0.9	89.1	13.2	Minimum Mean Maximum	7.9 9.3 10.8
				+22.35	100.0	0.9	99.1	13.2	Minimum Mean Maximum	7.8 8.8 9.8

Table D23.

Stream Name Rosgen Channel Type	Target Temperature	Model Run Dates	Segment Length (mi.)	Solar Radiation Components 24 hours (+/-) (joules/m²/sec)	% Total Shade	% Topo Shade	% Veg Shade	Width/ Depth Ratio	Temperature (24 hours)	ºC
Deep Creek, Current to Pole Creek F	13ºC Max 9ºC Avg.	June 1 through June 30	15.8	+145.86	34.4	34.4	0.0	27.6	Minimum Mean Maximum	9.5 12.3 15.1
				+149.64	34.4	34.4	0.0	11.6	Minimum Mean Maximum	9.3 11.7 14.2
				+109.78	50.0	34.4	15.6	11.6	Minimum Mean Maximum	9.1 11.1 13.2
				+45.75	75.0	34.4	40.6	11.6	Minimum Mean Maximum	8.9 10.2 11.5
				+7.34	90.0	34.4	55.6	11.6	Minimum Mean Maximum	8.7 9.6 10.5
				-18.27	100.0	34.4	66.6	11.6	Minimum Mean Maximum	8.6 9.2 9.8
Upper Pole Creek A, B, C and F	13ºC Max 9ºC Avg.	June 1 through June 30	6.8	+241.66	14.7	1.7	13.0	22.4	Minimum Mean Maximum	8.5 13.1 17.6
				+238.59	15.9	1.7	14.2	11.5	Minimum Mean Maximum	8.1 12.6 17.2
				+150.83	50.0	1.7	48.3	11.5	Minimum Mean Maximum	7.9 11.1 14.2
				+86.53	75.0	1.7	73.3	11.5	Minimum Mean Maximum	7.8 9.9 12.0
				+47.95	90.0	1.7	88.3	11.5	Minimum Mean Maximum	7.8 9.2 10.6
				+22.24	100.0	1.7	98.3	11.5	Minimum Mean Maximum	7.8 8.7 9.7

Table D24. Discharge-Load Calculations

Sediment Discharge						

Castle Creek

Mean annual Discharge	Load Capacity 80 mg/l	Load Capacity ^@ 80 mg/l	Load Capacity 50 mg/l	Load Capacity ^@ 50 mg/l	Load Capacity ^@ 80 mg/l	Load Capacity ^@ 50 mg/l
cfs	mg/l	lbs/day	mg/l	lbs/day	tons/year	tons/year
11.8	80	2.3E+03	50	1.44E+03	1.54E+05	9.61E+04

Deep Creek

Mean annual Discharge	Load Capacity 80 mg/l	Load Capacity ^@ 80 mg/l	Load Capacity 50 mg/l	Load Capacity ^@ 50 mg/l	Load Capacity ^@ 80 mg/l	Load Capacity ^@ 50 mg/l
cfs	mg/l	lbs/day	mg/l	lbs/day	tons/year	tons/year
52.03	80	1.0E+04	50	6.36E+03	6.78E+05	4.24E+05

Blue Creek

Mean annual Discharge	Load Capacity 80 mg/l	Load Capacity ^@ 80 mg/l	Load Capacity 50 mg/l	Load Capacity ^@ 50 mg/l	Load Capacity ^@ 80 mg/l	Load Capacity ^@ 50 mg/l
cfs	mg/l	lbs/day	mg/l	lbs/day	tons/year	tons/year
6.74	80	1.3E+03	50	8.24E+02	8.79E+04	5.49E+04

Juniper Creek

Mean annual Discharge	Load Capacity 80 mg/l	Load Capacity ^@ 80 mg/l	Load Capacity 50 mg/l	Load Capacity ^@ 50 mg/l	Load Capacity ^@ 80 mg/l	Load Capacity ^@ 50 mg/l
cfs	mg/l	lbs/day	mg/l	lbs/day	tons/year	tons/year
1.96	80	3.84E+02	50	2.40E+02	2.55E+04	1.60E+04

Table D25. Discharge-Load Calculations

Reverse load Analysis
Tons to
mg/l

Deep Creek											
	Low Yeild Bank Erosion	Low Yeild Bank Erosion	Low Yeild Bank Erosion	Low Yeild Bank Erosion	Conversion kg to mg	mg sec	Flow	mg/cubic foot	Concentration		
	tons/year	tons/day	kg/day	mg/day	1E-06 or 0.000001				mg/l		
	3420.00	9.4	8498.5	8.50E+09	1.00E-06	98362	52	1891.57	66.8		

Deep Creek												
		Load Capacity	Conversion	mg/cubic foot	Conversion	Kg/cf	Conversion	Sediment load	Conversion	Tons per	Number of	Tons/year
	Mean annual Discharge	Concentration	Factor cubic feet to		mg to kg 1E-06 or		seconds/day	at kg/day	kg to tons 1kg =	day	Days/year	
	cfs	mg/l	liters		0.000001				0.0011 tons		365	
	52	66.8	28.312	9.84E+04	1.00E-06	9.84E-02	86400	8.50E+03	0.0011	9.35E+00	365	3412

Deep Creek											
	High Yield Bank Erosion	High Yield Bank Erosion	High Yield Bank Erosion	High Yield Bank Erosion	Conversion kg to mg	mg sec	Flow	mg/cubic foot	Concentration		
	tons/year	tons/day	kg/day	mg/day	1E-06 or 0.000001				mg/l		
	56196.00	154.0	139643.2	1.40E+11	1.00E-06	1616241	52	31081.56	1097.7		

Deep Creek												
		Load Capacity	Conversion	mg/cubic foot	Conversion	Kg/cf	Conversion	Sediment load	Conversion	Tons per	Number of	Tons/year
	Mean annual Discharge		Factor cubic feet to		mg to kg 1E-06 or		seconds/day	at kg/day	kg to tons 1kg =	day	Days/year	
	cfs	mg/l	liters		0.000001				0.0011 tons		365	
	52	1097.7	28.312	1.62E+06	1.00E-06	1.62E+00	86400	1.40E+05	0.0011	1.54E+02	365	56061

Table D26. Discharge-Load Calculations

Reverse load Analysis
Tons to
mg/l

Castle Creek											
	Low Yeild	Low Yeild	Low Yeild	Low Yeild	Conversion	mg sec	Flow	mg/cubic foot	Concentration		
	Bank Erosion	Bank Erosion	Bank Erosion	Bank Erosion	kg to mg						
					1E-06 or						
	tons/year	tons/day	kg/day	mg/day	0.000001				mg/l		
	156.00	0.4	387.6	3.88E+08	1.00E-06	4487	11.8	380.23	13.4		

Castle Creek												
		Load Capacity	Conversion	mg/cubic foot	Conversion	Kg/cf	Conversion	Sediment load	Conversion	Tons per	Number of	Tons/year
	Mean annual	Concentration	Factor		mg to kg		seconds/day	at kg/day	kg to tons	day	Days/year	
	Discharge		cubic feet to		1E-06 or				1kg =			
	cfs	mg/l	liters		0.000001				0.0011 tons		365	
	11.8	13.4	28.312	4.49E+03	1.00E-06	4.49E-03	86400	3.88E+02	0.0011	4.26E-01	365	156

Castle Creek											
	High Yield	High Yield	High Yield	High Yield	Conversion	mg sec	Flow	mg/cubic foot	Concentration		
	Bank Erosion	Bank Erosion	Bank Erosion	Bank Erosion	kg to mg						
					1E-06 or						
	tons/year	tons/day	kg/day	mg/day	0.000001				mg/l		
	2580.00	7.1	6411.1	6.41E+09	1.00E-06	74203	11.8	6288.37	222.1		

Castle Creek												
		Load Capacity	Conversion	mg/cubic foot	Conversion	Kg/cf	Conversion	Sediment load	Conversion	Tons per	Number of	Tons/year
	Mean annual		Factor		mg to kg		seconds/day	at kg/day	kg to tons	day	Days/year	
	Discharge		cubic feet to		1E-06 or				1kg =			
	cfs	mg/l	liters		0.000001				0.0011 tons		365	
	11.8	222.1	28.312	7.42E+04	1.00E-06	7.42E-02	86400	6.41E+03	0.0011	7.05E+00	365	2574

Table D27. Discharge-Load Calculations

Reverse load Analysis
Tons to mg/l

Juniper Creek											
	Low Yeild	Low Yeild	Low Yeild	Low Yeild	Conversion	mg sec	Flow	mg/cubic foot	Concentration		
	Bank Erosion	Bank Erosion	Bank Erosion	Bank Erosion	kg to mg						
					1E-06 or						
	tons/year	tons/day	kg/day	mg/day	0.000001				mg/l		
	492.00	1.3	1222.6	1.22E+09	1.00E-06	14150	2	7075.15	249.9		

Juniper Creek													
		Load Capacity	Conversion	mg/cubic foot	Conversion	Kg/cf	Conversion	Sediment load	Conversion	Tons per	Number of	Tons/year
	Mean annual	Concentration	Factor		mg to kg		seconds/day	at kg/day	kg to tons	day	Days/year	
	Discharge		cubic feet to		1E-06 or				1kg =			
	cfs	mg/l	liters		0.000001				0.0011 tons		365	
	2	249.9	28.312	1.41E+04	1.00E-06	1.41E-02	86400	1.22E+03	0.0011	1.34E+00	365	491

Juniper Creek											
	High Yield	High Yield	High Yield	High Yield	Conversion	mg sec	Flow	mg/cubic foot	Concentration		
	Bank Erosion	Bank Erosion	Bank Erosion	Bank Erosion	kg to mg						
					1E-06 or						
	tons/year	tons/day	kg/day	mg/day	0.000001				mg/l		
	8100.00	22.2	20127.9	2.01E+10	1.00E-06	232962	2	116481.16	4113.8		

Juniper Creek													
		Load Capacity	Conversion	mg/cubic foot	Conversion	Kg/cf	Conversion	Sediment load	Conversion	Tons per	Number of	Tons/year
	Mean annual		Factor		mg to kg		seconds/day	at kg/day	kg to tons	day	Days/year	
	Discharge		cubic feet to		1E-06 or				1kg =			
	cfs	mg/l	liters		0.000001				0.0011 tons		365	
	2	4113.8	28.312	2.33E+05	1.00E-06	2.33E-01	86400	2.01E+04	0.0011	2.21E+01	365	8081

Table D28. Discharge-Load Calculations

Reverse load Analysis
Tons to mg/l

Blue Creek												
	Low Yeild	Low Yeild	Low Yeild	Low Yeild	Conversion	mg sec	Flow	mg/cubic foot	Concentration			
	Bank Erosion	Bank Erosion	Bank Erosion	Bank Erosion	kg to mg							
					1E-06 or							
	tons/year	tons/day	kg/day	mg/day	0.000001				mg/l			
	326.00	0.9	810.1	8.10E+08	1.00E-06	9376	6.7	1399.41	49.4			

Blue Creek												
		Load Capacity	Conversion	mg/cubic foot	Conversion	Kg/cf	Conversion	Sediment load	Conversion	Tons per	Number of	Tons/year
	Mean annual	Concentration	Factor		mg to kg		seconds/day	at kg/day	kg to tons	day	Days/year	
	Discharge		cubic feet to		1E-06 or				1kg =			
	cfs	mg/l	liters		0.000001				0.0011 tons		365	
	6.7	49.4	28.312	9.38E+03	1.00E-06	9.38E-03	86400	8.10E+02	0.0011	8.91E-01	365	325

Blue Creek												
	High Yield	High Yield	High Yield	High Yield	Conversion	mg sec	Flow	mg/cubic foot	Concentration			
	Bank Erosion	Bank Erosion	Bank Erosion	Bank Erosion	kg to mg							
					1E-06 or							
	tons/year	tons/day	kg/day	mg/day	0.000001				mg/l			
	5370.00	14.7	13344.1	1.33E+10	1.00E-06	154445	6.7	23051.55	814.1			

Blue Creek												
		Load Capacity	Conversion	mg/cubic foot	Conversion	Kg/cf	Conversion	Sediment load	Conversion	Tons per	Number of	Tons/year
	Mean annual		Factor		mg to kg		seconds/day	at kg/day	kg to tons	day	Days/year	
	Discharge		cubic feet to		1E-06 or				1kg =			
	cfs	mg/l	liters		0.000001				0.0011 tons		365	
	6.7	814.1	28.312	1.54E+05	1.00E-06	1.54E-01	86400	1.33E+04	0.0011	1.47E+01	365	5357

Table D29. Discharge-Load Calculations

Reverse load Analysis
Tons to mg/l

Nickel Creek											
	Low Yeild	Low Yeild	Low Yeild	Low Yeild	Conversion	mg sec	Flow	mg/cubic foot	Concentration		
	Bank Erosion	Bank Erosion	Bank Erosion	Bank Erosion	kg to mg						
					1E-06 or						
	tons/year	tons/day	kg/day	mg/day	0.000001				mg/l		
	23.50	0.1	58.4	5.84E+07	1.00E-06	676	0.4	1689.70	59.7		

Nickel Creek												
		Load Capacity	Conversion	mg/cubic foot	Conversion	Kg/cf	Conversion	Sediment load	Conversion	Tons per	Number of	Tons/year
	Mean annual	Concentration	Factor		mg to kg		seconds/day	at kg/day	kg to tons	day	Days/year	
	Discharge		cubic feet to		1E-06 or				1kg =			
	cfs	mg/l	liters		0.000001				0.0011 tons		365	
	0.4	59.7	28.312	6.76E+02	1.00E-06	6.76E-04	86400	5.84E+01	0.0011	6.42E-02	365	23

Nickel Creek											
	High Yield	High Yield	High Yield	High Yield	Conversion	mg sec	Flow	mg/cubic foot	Concentration		
	Bank Erosion	Bank Erosion	Bank Erosion	Bank Erosion	kg to mg						
					1E-06 or						
	tons/year	tons/day	kg/day	mg/day	0.000001				mg/l		
	387.00	1.1	961.7	9.62E+08	1.00E-06	11130	0.4	27826.06	982.7		

Nickel Creek												
		Load Capacity	Conversion	mg/cubic foot	Conversion	Kg/cf	Conversion	Sediment load	Conversion	Tons per	Number of	Tons/year
	Mean annual		Factor		mg to kg		seconds/day	at kg/day	kg to tons	day	Days/year	
	Discharge		cubic feet to		1E-06 or				1kg =			
	cfs	mg/l	liters		0.000001				0.0011 tons		365	
	0.4	982.7	28.312	1.11E+04	1.00E-06	1.11E-02	86400	9.62E+02	0.0011	1.06E+00	365	386

Table D30 12 Month Discharge Model Castle Creek

Estimated Table
Flows
6th Field
HUC
17050104 Castle Creek
0603

Area	Area	Mean Basin Elevation	Basin Relief	Slopes >30%		Mean Annual Precip.	Landuse Forested	Basin Slope Average	Distance Total	Distance ^10 & 85%	Elevation Change	Elevation Change ^@10 and 85%		Main Channel Slope
Acres	Miles	feet	feet	%		in	%	%	miles	miles	meters	feet		ft/miles
15372	24	6400	1664	20		14.6	30	20	11	10		1280		155.15

		Total		A	BS	S30	F		Total	
A=	24	Discharge		0.963	-3.44	2.52	0.646		Discharge	
E=	5.4	Power							cfs	
BR=	1664			24	20	21	31			
S30=S+1 %=	21									
P=	14.6									
F=	31	Qa=	8.37E-01	21.34	0.0000335	2147.79	9.19		11.80	
BS=	20									
MCS=	155.2									

Power June	MCS	F	P			Power July	MCS	F	P				Power August	MCS	F	
Q80	-1.46	0.775	1.21			Q80	-1.21	0.587	0.0617				Q80	-1.03	0.465	
Q50	-1.53	0.844	1.65			Q50	-1.36	0.698	0.464				Q50	-1.28	0.57	
Q20	-1.55	0.793	1.9			Q20	-1.55	0.734	0.876				Q20	-1.39	0.648	

June		MCS	F	P	Flow	July		MCS	F	P	Flow		August		MCS	F	Flow
Q.80=	5.47E+01	0.0006331	14.3155	25.64	12.71	Q.80=	2.66E+02	2.23E-03	7.50636	1.18	5.26		Q.80=	1.34E+02	5.54E-03	4.93723	3.67
Q.50=	3.59E+01	0.00044 48	18.143	83.40	24.16	Q.50=	2.43E+02	1.05E-03	10.9893	3.47	9.71		Q.50=	4.80E+02	1.57E-03	7.0807	5.34
Q.20=	4.31E+01	0.00040 21	15.2282	163.03	43.03	Q.20=	2.85E+02	4.02E-04	12.4354	10.47	14.92		Q.20=	9.86E+02	9.01E-04	9.25555	8.22

Standard Error				**Flow**	**Flow**	Standard Error				**Flow**	**Flow**		Standard Error				**Flow**	**Flow**
June				**cfs**	**cfs**	July				**cfs**	**cfs**		August				**cfs**	**cfs**

Q80	143.7%	to	-59.0%	**30.98**	**5.21**	Q80	185.6%	to	-65.0%	**15.03**	**1.84**			Q80	214.8%	to	-68.2%	**11.54**	**1.17**
Q50	165.6%		-62.4%	**64.17**	**39.24**	Q50	155.3%		-60.8%	**24.80**	**3.81**			Q50	195.7%		-66.2%	**15.78**	**1.80**
Q20	167.4%		-62.6%	**115.05**	**69.96**	Q20	140.0%		-58.3%	**35.81**	**6.22**			Q20	163.3%		-62.0%	**21.66**	**3.13**

Power September	MCS	F		Power October	MCS	F		Power November	MCS	F
Q80	-0.992	0.469		Q80	-1.09	0.432		Q80	-1.26	0.503
Q50	-1.23	0.503		Q50	-1.27	0.523		Q50	-1.36	0.568
Q20	-1.36	0.547		Q20	-1.43	0.598		Q20	-1.42	0.594

September	MCS	F	Flow	October	MCS	F	Flow	November	MCS	F	Flow
Q.80=	1.10E+02	0.00671 5.005 51	3.69	Q.80=	2.27E+02	4.09E-03 4	4.10	Q.80=	5.28E+02	1.74E-03 5.625 42	5.16
Q.50=	3.98E+02	0.00202 01 5.625 42	4.52	Q.50=	5.77E+02	1.65E-03 6	5.74	Q.50=	9.89E+02	1.05E-03 7.032 24	7.29
Q.20=	9.48E+02	0.00104 85 6.542 97	6.50	Q.20=	1.56E+03	7.37E-04 8	8.96	Q.20=	1.71E+03	7.75E-04 7.688 98	10.19

Standard Error September				**Flow** cfs	**Flow** cfs	Standard Error October				**Flow** cfs	**Flow** cfs			Standard Error Novemebr				**Flow** cfs	**Flow** cfs
Q80	204.1%	to	-67.1%	**11.24**	**1.22**	Q80	161.2%	to	-61.7%	**10.70**	**1.57**			Q80	115.9%	to	-53.7%	**11.13**	**2.39**
Q50	192.2%		-65.8%	**13.22**	**1.55**	Q50	137.8%		-58.0%	**13.65**	**2.41**			Q50	99.2%		49.8%	**14.53**	**10.92**
Q20	172.3%		-63%	**17.71**	**2.39**	Q20	103.6%		50.9%	**18.24**	**13.52**			Q20	89.8%		47.3%	**19.33**	**15.00**

Power December	MCS	F	P	Power January	E	S30	MCS	F	Power February	E	S30	MCS	F
Q80	-1.26	0.507		Q80	-0.526	0.209	-1.33	0.485	Q80	-1.130	0.488	-1.47	0.47
Q50	-1.35	0.565		Q50	-1.55	0.468	-1.41	0.548	Q50	-3.06	0.939	-1.53	0.548
Q20	-1.29	0.606		Q20	-3.85	1.02	-1.49	0.705	Q20	-4.06	1.21	-1.56	0.515

December	MCS	F	P	Flow	January	E	S30	MCS	F	Flow	February	E	S30	MCS	F	Flow

Q.80=	5.97E+02	0.0017364	5.70322	1.00	5.91	Q.80=	1.16E+03	4.12E-01	1.88949	0.001220	5.3	5.82	Q.80=	3.94E+03	1.49E-01	4.41818	0.000602	5.0	7.83E+00
Q.50=	1.02E+03	0.0011028	6.96016	1.00	7.83	Q.50=	5.82E+03	7.32E-02	4.15718	0.000815	6.6	9.48	Q.50=	5.18E+04	5.74E-03	17.4407	0.000445	6.6	1.51E+01
Q.20=	1.14E+03	0.0014925	8.01245	1.00	13.63	Q.20=	1.27E+05	1.51E-03	22.3184	0.000544	11.3	26.30	Q.20=	3.05E+05	1.06E-03	39.8002	0.000382	5.9	2.89E+01

Standard Error December				Flow		Flow	Standard Error January			Flow	Flow			Standard Error February				Flow	Flow
				cfs		cfs				cfs	cfs							cfs	cfs
Q80	91.9%	to	-47.9%	11.35		3.08	Q80	90.9%	to	-47.6%	11.12	2.77		Q80	88.1%	to	-46.8%	14.72	2.67
Q50	91.2%		47.7%	14.97		11.56	Q50	88.4%		-47.7%	17.86	3.43		Q50	99.7%		-49.9%	30.24	3.29
Q20	107.0%		51.7%	28.22		20.68	Q20	89.2%		-51.7%	49.76	5.44		Q20	125.4%		-55.6%	65.18	2.60

Power March	A	E	S30	F		Power April	BS	S30	MCS	F		Power May	MCS		F	P
Q80	0.922	-1.75	0.354	0.537		Q80	-3.340	2.8	-1.52	0.795		Q80	-1.480		0.817	1.9
Q50	1	-2.97	0.684	0.546		Q50	-2.12	2.01	-1.55	0.746		Q50	-1.49		0.862	2.13
Q20	1.04	-3.59	0.82	0.470		Q20	-0.607	1.02	-1.57	0.57		Q20	-1.43		0.699	2.26

March		A	E	S30	F	Flow	April		BS	S30	MCS	F	Flow	May			F	P	Flow
Q.80=	4.10E-01	18.73073	5.2E-02	2.94	6.32	7.46	Q.80=	1.17E+04	4.51E+05	5037.49	0.00046 8	15.333	19.15	Q.80=	1.28E+00	5.72E-04	16.54	163.031	1.98
Q.50=	1.58E+00	24.00000	6.7E-03	8.02	6.52	13.25	Q.50=	9.86E+03	1.75E-03	454.633	0.00040 2	13.0	40.76	Q.50=	1.38E+00	5.44E-04	13.23	302.045	3.00
Q.20=	6.34E+00	27.25334	2.3E-03	12.14	5.02	24.74	Q.20=	7.66E+03	1.62E-01	22.3184	0.00036 4	7.1	71.41	Q.20=	1.91E+00	7.37E-04	33.99	427.994	20.47

Standard Error March				Flow		Flow	Standard Error April			Flow	Flow			Standard Error May				Flow	Flow
				cfs		cfs				cfs	cfs							cfs	cfs
Q80	131.0%	to	-56.7%	17.23		3.23	Q80	110.5%	to	-52.5%	40.31	9.10		Q80	151.5%	to	-60.2%	4.97	0.79
Q50	139.1%		-58.3%	31.69		5.53	Q50	139.6%		-58.3%	97.66	17.00		Q50	180.3%		-64.3%	8.41	1.07
Q20	132.2%		-56.9%	57.44		10.66	Q20	161.5%		61.8%	186.74	115.54		Q20	163.9%		-62.6%	54.01	7.65

Table D31 12 Month Discharge Model Blue Creek

Estimated Flows
6th Field HUC
Blue Creek Reservoir

Area	Area	Mean Basin Elevation	Basin Relief	Slopes >30%		Mean Annual Precip.	Landuse Forested	Basin Slope Average	Distance Total	Distance ^10 & 85%	Elevation Change	Elevation Change ^@10 and 85%		Main Channel Slope
Acres	Miles	feet	feet	%		in	%	%	miles	miles	meters	feet		ft/miles
39224	61.3	5760	800	10		15	0	10	20.2	13.8		620		40.92

A= 61.3
E= 5.4
BR= 800
S30=S+1%= 11
P= 15
F= 1

BS= 10
MCS= 40.9

		Total						
		Discharge Power		A	BS	S30	F	Total Discharge cfs
				0.963	-3.44	2.52	0.646	
				61.3	10	11	1	
		Qa=	8.37E-01	52.64	######	421.03	1.00	6.74

Power	MCS	F	P			Power	MCS	F	P			Power	MCS	F	
June						July						August			
Q80	-1.46	0.775	1.21			Q80	-1.21	0.587	0.0617			Q80	-1.03	0.465	
Q50	-1.53	0.844	1.65			Q50	-1.36	0.698	0.464			Q50	-1.28	0.57	
Q20	-1.55	0.793	1.9			Q20	-1.55	0.734	0.876			Q20	-1.39	0.648	
June	MCS	F	P	Flow		July	MCS	F	P	Flow		August	MCS	F	Flow
Q.80=	5.47E+01	0.004431	1	26.49	6.42	Q.80=	2.66E+02	1.12E-02	1	1.18	3.52	Q.80=	1.34E+02	2.19E-02	1	2.93
Q.50=	3.59E+01	0.003417	1	87.21	10.70	Q.50=	2.43E+02	6.42E-03	1	3.51	5.48	Q.50=	4.80E+02	8.64E-03	1	4.15
Q.20=	4.31E+	0.003173	1	171.62	23.47	Q.20=	2.85E+02	3.17E-03	1	10.72	9.69	Q.20=	9.86E+02	5.75E-03	1	5.67

Standard Error June				Flow cfs	Flow cfs	Standard Error July				Flow cfs	Flow cfs			Standard Error August				Flow cfs	Flow cfs
Q80	143.7%	to	-59.0%	15.65	2.63	Q80	185.6%	to	-65.0%	10.06	1.23			Q80	214.8%	to	-68.2%	9.22	0.93
Q50	165.6%		-62.4%	28.41	17.37	Q50	155.3%		-60.8%	14.00	2.15			Q50	195.7%		-66.2%	12.27	1.40
Q20	167.4%		-62.6%	62.75	38.16	Q20	140.0%		-58.3%	23.27	4.04			Q20	163.3%		-62.0%	14.92	2.15

Power September	MCS	F	Power October	MCS	F	Power November	MCS	F
Q80	-0.992	0.469	Q80	-1.09	0.432	Q80	-1.26	0.503
Q50	-1.23	0.503	Q50	-1.27	0.523	Q50	-1.36	0.568
Q20	-1.36	0.547	Q20	-1.43	0.598	Q20	-1.42	0.594

September	MCS	F		Flow	October	MCS	F		Flow	November	MCS	F		Flow
Q.80=	1.10E+02	0.025172	1	2.77	Q.80=	2.27E+02	1.75E-02	1	3.97	Q.80=	5.28E+02	9.31E-03	1	4.92
Q.50=	3.98E+02	0.010406	1	4.14	Q.50=	5.77E+02	8.97E-03	1	5.18	Q.50=	9.89E+02	6.42E-03	1	6.35
Q.20=	9.48E+02	0.006423	1	6.09	Q.20=	1.56E+03	4.95E-03	1	7.73	Q.20=	1.71E+03	5.14E-03	1	8.79

Standard Error September				Flow cfs	Flow cfs	Standard Error October				Flow cfs	Flow cfs			Standard Error Novemebr				Flow cfs	Flow cfs
Q80	204.1%	to	-67.1%	8.42	0.91	Q80	161.2%	to	-61.7%	10.37	1.52			Q80	115.9%	to	-53.7%	10.61	2.28
Q50	192.2%		-65.8%	12.10	1.42	Q50	137.8%		-58.0%	12.31	2.17			Q50	99.2%		49.8%	12.65	9.52
Q20	172.3%		-63%	16.58	2.23	Q20	103.6%		50.9%	15.73	11.66			Q20	89.8%		47.3%	16.68	12.95

Power December	MCS	F	P	Power January	E	S30	MCS	F	Power February	E	S30	MCS	F

Q80	-1.26	0.507				Q80	-0.526	0.209	-1.33	0.485		Q80	-1.130	0.488	-1.47 0.47
Q50	-1.35	0.565				Q50	-1.55	0.468	-1.41	0.548		Q50	-3.06	0.939	-1.53 0.548
Q20	-1.29	0.606				Q20	-3.85	1.02	-1.49	0.705		Q20	-4.06	1.21	-1.56 0.515

December	MCS	F	P	Flow	January	E	S30	MCS	F	Flow	February	E	S30	MCS	F
Q.80=	5.97E+02	1	1.00	5.56	Q.80= 1.16E+03	4.12E-01	1.650635	0.007179	1.0	5.66	Q.80= 3.94E+03	1.49E-01	3.22255	0.004270	1.0
	0.009309														
Q.50=	1.02E+03	1	1.00	6.80	Q.50= 5.82E+03	7.32E-02	3.07165	0.005335	1.0	6.99	Q.50= 5.18E+04	5.74E-03	9.503153	0.003417	1.0
	0.006665														
Q.20=	1.14E+03	1	1.00	9.49	Q.20= 1.27E+05	1.51E-03	11.54039	0.003964	1.0	8.80	Q.20= 3.05E+05	1.06E-03	18.20058	0.003057	1.0
	0.008328														

Standard Error December				**Flow**		**Flow**	Standard Error January			**Flow**	**Flow**		Standard Error February			**Flow**	**Flow**
				cfs		**cfs**				**cfs**	**cfs**					**cfs**	**cfs**
Q80	91.9%	to	-47.9%	**10.66**		**2.90**	Q80	90.9%	to	-47.6%	**10.81**	0.52	Q80	88.1%	to	-46.8%	**15.17** 0.53
Q50	91.2%		-47.7%	**13.00**		**3.56**	Q50	88.4%		-47.7%	**13.16**	0.52	Q50	99.7%		-49.9%	**19.28** 0.50
Q20	107.0%		-51.7%	**19.65**		**4.59**	Q20	89.2%		-51.7%	**16.65**	0.48	Q20	125.4%		-55.6%	**40.66** 0.44

Power March	A	E	S30	F		Power April	BS	S30	MCS	F		Power May	MCS	F	P
Q80	0.922	-1.75	0.354	0.537		Q80	-3.340	2.8	-1.52	0.795		Q80	-1.480	0.817	1.9
Q50	1	-2.97	0.684	0.546		Q50	-2.12	2.01	-1.55	0.746		Q50	-1.49	0.862	2.13
Q20	1.04	-3.59	0.82	0.470		Q20	-0.607	1.02	-1.57	0.57		Q20	-1.43	0.699	2.26

June	A	E	S30	F	Flow	April	BS	S30	MCS	F	Flow	July	F	P	Flow
Q.80=	4.10E-01	44.46707	5.2E-02	2.34	1.00 2.23	Q.80= 1.17E+04	4.57E-04	823.9475	0.003546	1.0	15.68	Q.80= 1.28E+00	1	9.138324	11.70
Q.50=	1.58E+00	61.30000	6.7E-03	5.16	1.00 3.34	Q.50= 9.86E+03	7.59E-03	123.9365	0.003173	1.0	29.41	Q.50= 1.38E+00	1	10.32264	14.25
Q.20=	6.34E+00	72.27014	2.3E-03	7.14	1.00 7.69	Q.20= 7.66E+03	2.47E-01	11.54039	0.002946	1.0	64.36	Q.20= 1.91E+00	1	6.638773	12.68

Standard Error				**Flow**		**Flow**	Standard Error			**Flow**	**Flow**		Standard Error			**Flow**	**Flow**

March				cfs		cfs	April				cfs	cfs			May				cfs	cfs
Q80	131.0%	to	-56.7%	5.15		0.96	Q80	110.5%	to	-52.5%	33.01	7.45			Q80	151.5%	to	-60.2%	29.42	4.66
Q50	139.1%		-58.3%	7.98		1.39	Q50	139.6%		-58.3%	70.47	12.26			Q50	180.3%		-64.3%	39.93	5.09
Q20	132.2%		-56.9%	17.85		3.31	Q20	161.5%		61.8%	168.31	104.14			Q20	163.9%		-62.6%	33.46	4.74

Table D32 12 Month Discharge Model Juniper Creek

Estimated Flows
6th
Field
HUC
170501   Juniper Basin
 040603

Area	Area	Mean Basin Elevation	Basin Relief	Slopes >30%	Mean Annual Precip.	Landuse Forested	Basin Slope Average	Distance Total	Distance ^10 & 85%	Elevation Change	Elevation Change ^@10 and 85 %	Main Channel Slope
Acres	Miles	feet	feet	%	in	%	%	miles	miles	meters	feet	ft/miles
53051	82.9	5400	400	5	14.6	0	10	12.9	10.6		482	49.82

A=	82.9	Total Discharge			A	BS	S30	F	Total
E=	5.4				0.963	-3.44	2.52	0.646	Discharge cfs
BR=	4006	Power			82.9	10	6	1	
S30=S+1%=									
P=	14.6								
F=	1	Qa=	8.37E-01		70.40	0.00036 31	91.40	1.00	1.96
BS=	10								
MCS=	49.8								

Power June	MCS	F	P				Power July	MCS	F	P			Power August	MCS	F	
Q80	-1.46	0.775	1.21				Q80	-1.21	0.587	0.0617			Q80	-1.03	0.465	
Q50	-1.53	0.844	1.65				Q50	-1.36	0.698	0.464			Q50	-1.28	0.57	
Q20	-1.55	0.793	1.9				Q20	-1.55	0.734	0.876			Q20	-1.39	0.648	

June		MCS	F	P	Flow	July		MCS	F	P	Flow	August		MCS	F	Flow
Q.80=	5.47E+01	0.003325077	1	25.64	4.66	Q.80=	2.66E+02	8.83E-03	1	1.18	2.77	Q.80=	1.34E+02	1.79E-02	1	2.39
Q.50=	3.59E+01	0.002529205	1	83.40	7.57	Q.50=	2.43E+02	4.92E-03	1	3.47	4.14	Q.50=	4.80E+02	6.72E-03	1	3.23
Q.20=	4.31E+01	0.002339032	1	163.03	16.44	Q.20=	2.85E+02	2.34E-03	1	10.47	6.98	Q.20=	9.86E+02	4.37E-03	1	4.31

Standard Error June				Flow cfs	Flow cfs	Standard Error July				Flow cfs	Flow cfs	Standard Error August				Flow cfs	Flow cfs
Q80	143.7%	to	-59.0%	11.36	1.91	Q80	185.6%	to	-65.0%	7.92	0.97	Q80	214.8%	to	-68.2%	7.53	0.76
Q50	165.6%		-62.4%	20.11	12.30	Q50	155.3%		-60.8%	10.58	1.62	Q50	195.7%		-66.2%	9.54	1.09
Q20	167.4%		-62.6%	43.95	26.72	Q20	140.0%		-58.3%	16.75	2.91	Q20	163.3%		-62.0%	11.35	1.64

Power September	MCS	F
Q80	-0.992	0.469
Q50	-1.23	0.503
Q20	-1.36	0.547

September	MCS	F		Flow
Q.80=	1.10E+02	0.020710143	1	2.28
Q.50=	3.98E+02	0.008169639	1	3.25
Q.20=	9.48E+02	0.004915202	1	4.66

Power October	MCS	F
Q80	-1.09	0.432
Q50	-1.27	0.523
Q20	-1.43	0.598

October	MCS	F		Flow
Q.80=	2.27E+02	1.41E-02	1	3.21
Q.50=	5.77E+02	6.99E-03	1	4.03
Q.20=	1.56E+03	3.74E-03	1	5.83

Power November	MCS	F
Q80	-1.26	0.503
Q50	-1.36	0.568
Q20	-1.42	0.594

November	MCS	F		Flow
Q.80=	5.28E+02	7.27E-03	1	3.84
Q.50=	9.89E+02	4.92E-03	1	4.86
Q.20=	1.71E+03	3.89E-03	1	6.65

Standard Error September				Flow cfs		Flow cfs
Q80	204.1%	to	-67.1%	6.93		0.75
Q50	192.2%		-65.8%	9.50		1.11
Q20	172.3%		-63%	12.69		1.71

Standard Error October				Flow cfs	Flow cfs
Q80	161.2%	to	-61.7%	8.37	1.23
Q50	137.8%		-58.0%	9.59	1.69
Q20	103.6%		50.9%	11.87	8.80

Standard Error November				Flow cfs	Flow cfs
Q80	115.9%	to	-53.7%	8.28	1.78
Q50	99.2%		49.8%	9.68	7.28
Q20	89.8%		47.3%	12.62	9.79

Power December	MCS	F	P
Q80	-1.26	0.507	
Q50	-1.35	0.565	
Q20	-1.29	0.606	

December	MCS	F	P	Flow
Q.80=	5.97E+02	0.0072 5759	1	1.00	4.34
Q.50=	1.02E+03	0.00511 1111	1	1.00	5.21
Q.20=	1.14E+03	0.00646 1883	1	1.00	7.37

Power January	E	S30	MCS	F
Q80	-0.526	0.209	-1.33	0.485
Q50	-1.55	0.468	-1.41	0.548
Q20	-3.85	1.02	-1.49	0.705

January	E	S30	MCS	F	Flow
Q.80=	1.16E+03	4.12E-01	1.45423171	0.005527	1.0	3.84
Q.50=	5.82E+03	7.32E-02	2.31299549	0.004043	1.0	3.99
Q.20=	1.27E+05	1.51E-03	6.21891005	0.002957	1.0	3.54

Power February	E	S30	MCS	F
Q80	-1.130	0.488	-1.47	0.47
Q50	-3.06	0.939	-1.53	0.548
Q20	-4.06	1.21	-1.56	0.515

February	E	S30	MCS	F	Flow
Q.80=	3.94E+03	1.49E-01	2.39738 515	0.003198	1.0	4.49E+00
Q.50=	5.18E+04	5.74E-03	5.37878 301	0.002529	1.0	4.04E+00
Q.20=	3.05E+05	1.06E-03	8.74103 809	0.002249	1.0	6.37E+00

Standard Error December				Flow cfs		Flow cfs
Q80	91.9%	to	-47.9%	8.32		2.26
Q50	91.2%		47.7%	9.97		7.70
Q20	107.0%		51.7%	15.25		11.18

Standard Error January				Flow cfs	Flow cfs
Q80	90.9%	to	-47.6%	7.33	0.52
Q50	88.4%		-47.7%	7.51	0.52
Q20	89.2%		-51.7%	6.69	0.48

Standard Error February				Flow cfs	Flow cfs
Q80	88.1%	to	-46.8%	8.45	0.53
Q50	99.7%		-49.9%	8.08	0.50
Q20	125.4%		-55.6%	14.37	0.44

Power	A	E	S30	F

Power	BS	S30	MCS	F

Power	MCS	F	P

March						April						May			
Q80	0.922	-1.75	0.354	0.537		Q80	-3.340	2.8	-1.52	0.795		Q80	-1.480	0.817	1.9
Q50	1	-2.97	0.684	0.546		Q50	-2.12	2.01	-1.55	0.746		Q50	-1.49	0.862	2.13
Q20	1.04	-3.59	0.82	0.470		Q20	-0.607	1.02	-1.57	0.57		Q20	-1.43	0.699	2.26

June		A	E	S30	F	Flow	April		BS	S30	MCS	F	Flow	July		F	P	Flow
Q.80=	4.10E-01	58.73639	5.2E-02	1.89	1.00	2.37	Q.80=	1.17E+04	4.57E-04	150.946658	0.002630	1.0	2.13	Q.80=	1.28E+00	1	8.93873955	11.44
Q.50=	1.58E+00	82.90000	6.7E-03	3.41	1.00	2.98	Q.50=	9.86E+03	7.59E-03	36.6508468	0.002339	1.0	6.41	Q.50=	1.38E+00	1	10.0849131	13.92
Q.20=	6.34E+00	98.92287	2.3E-03	4.35	1.00	6.40	Q.20=	7.66E+03	2.47E-01	6.21891005	0.002163	1.0	25.47	Q.20=	1.91E+00	1	6.51452337	12.44

Standard Error				Flow		Flow	Standard Error				Flow	Flow			Standard Error				Flow	Flow
March				cfs		cfs	April				cfs	cfs			May				cfs	cfs
Q80	131.0%	to	-56.7%	**5.48**		**1.03**	Q80	110.5%	to	-52.5%	**4.48**	**1.01**			Q80	151.5%	to	-60.2%	**28.78**	**4.55**
Q50	139.1%		-58.3%	**7.13**		**1.24**	Q50	139.6%		-58.3%	**15.36**	**2.67**			Q50	180.3%		-64.3%	**39.01**	**4.97**
Q20	132.2%		-56.9%	**14.86**		**2.76**	Q20	161.5%		61.8%	**66.60**	**41.21**			Q20	163.9%		-62.6%	**32.84**	**4.65**

Table D33 12 Month Discharge Model Deep Creek

Estimated Flows
6th Field HUC
170501 Deep Creek
 040603

Area	Area	Mean Basin Elevation	Basin Relief	Slopes >30%	Mean Annual Precip.	Landuse Forested	Basin Slope Average	Distance Total	Distance ^10 & 85%	Elevation Change	Elevation Change ^@10 and 85 %	Main Channel Slope
Acres	Miles	feet	feet	%	in	%	%	miles	miles	meters	feet	ft/miles
273563	427	5526	1920	10	14.9	29	18	38.1	27.3		912	31.92

A=	427		Total		A	BS	S30	F		Total
E=	5.4		Discharge		0.963	-3.44	2.52	0.646		Discharge
BR=	1920		Power		427	18	11	30		cfs
S30=S+ 1%=	11									
P=	14.9									
F=	30		Qa=	8.37E-01	341.27	0.0000481	421.03	9.00		52.03
BS=	18									
MCS=	31.9									

	Power	MCS	F	P		Power	MCS	F	P		Power	MCS	F
June					July					August			
Q80	-1.46	0.775	1.21		Q80	-1.21	0.587	0.0617		Q80	-1.03	0.465	
Q50	-1.53	0.844	1.65		Q50	-1.36	0.698	0.464		Q50	-1.28	0.57	
Q20	-1.55	0.793	1.9		Q20	-1.55	0.734	0.876		Q20	-1.39	0.648	

June		MCS	F	P	Flow	July		MCS	F	P	Flow	August		MCS	F	Flow
Q.80=	5.47E+01	0.006370118	13.956257	26.28	127.78	Q.80=	2.66E+02	1.51E-02	7.3632607	1.18	35.03	Q.80=	1.34E+02	2.82E-02	4.8625198	18.40
Q.50=	3.59E+01	0.004998812	17.64779	86.25	273.15	Q.50=	2.43E+02	9.01E-03	10.740652	3.50	82.33	Q.50=	4.80E+02	1.19E-02	6.9495889	39.63
Q.20=	4.31E+01	0.004664302	14.837378	169.45	505.45	Q.20=	2.85E+02	4.66E-03	12.139673	10.66	172.01	Q.20=	9.86E+02	8.12E-03	9.0609675	72.52

Standard Error			Flow		Flow	Standard Error			Flow	Flow		Standard Error			Flow	Flow
			cfs		cfs				cfs	cfs					cfs	cfs
June						July						August				
Q80	143.7%	to	-59.0%	311.40	52.39	Q80	185.6%	to	-65.0%	100.06	12.26	Q80	214.8%	to	-68.2%	57.93	5.85
Q50	165.6%		-62.4%	725.50	443.60	Q50	155.3%		-60.8%	210.18	32.27	Q50	195.7%		-66.2%	117.20	13.40
Q20	167.4%		-62.6%	1351.56	821.86	Q20	140.0%		-58.3%	412.82	71.73	Q20	163.3%		-62.0%	190.95	27.50

	Power	MCS	F		Power	MCS	F		Power	MCS	F
September				October				November			
Q80	-0.992	0.469		Q80	-1.09	0.432		Q80	-1.26	0.503	

Q50	-1.23	0.503		Q50	-1.27	0.523		Q50	-1.36	0.568	
Q20	-1.36	0.547		Q20	-1.43	0.598		Q20	-1.42	0.594	

September	MCS	F	Flow	October	MCS	F	Flow	November	MCS	F	Flow
Q.80=	1.10E+02	0.032212429	4.9291254	17.47	Q.80= 2.27E+02	2.29E-02	4	22.63	Q.80= 5.28E+02	1.27E-02	5.533339	37.20
Q.50=	3.98E+02	0.014127634	5.533339	31.11	Q.50= 5.77E+02	1.23E-02	6	42.04	Q.50= 9.89E+02	9.01E-03	6.9024755	61.48
Q.20=	9.48E+02	0.009006339	6.426666	54.87	Q.20= 1.56E+03	7.07E-03	8	84.28	Q.20= 1.71E+03	7.32E-03	7.5406716	94.34

Standard Error				**Flow** cfs	**Flow** cfs	Standard Error			**Flow** cfs	**Flow** cfs	Standard Error			**Flow** cfs	**Flow** cfs
September						October					November				
Q80	204.1%	to	-67.1%	53.11	5.75	Q80 161.2%	to	-61.7%	59.12	8.67	Q80 115.9%	to	-53.7%	80.32	17.22
Q50	192.2%		-65.8%	90.91	10.64	Q50 137.8%		-58.0%	99.96	17.66	Q50 99.2%		49.8%	122.47	92.10
Q20	172.3%		-63%	149.41	20.14	Q20 103.6%		50.9%	171.59	127.17	Q20 89.8%		47.3%	179.06	138.9

Power	MCS	F	P	Power	E	S30	MCS	F	Power	E	S30	MCS	F
December				January					February				
Q80	-1.26	0.507		Q80	-0.526	0.209	-1.33	0.485	Q80	-1.130	0.488	-1.47	0.47
Q50	-1.35	0.565		Q50	-1.55	0.468	-1.41	0.548	Q50	-3.06	0.939	-1.53	0.548
Q20	-1.29	0.606		Q20	-3.85	1.02	-1.49	0.705	Q20	-4.06	1.21	-1.56	0.515

December	MCS	F	P	Flow	January	E	S30	MCS	F	Flow	February	E	S30	MCS	F
Q.80=	5.97E+02	0.01273354	5.6091942	1.00	42.64	Q.80= 1.16E+03	4.12E-01	1.6506351	0.009992	5.2	41.01	Q.80= 3.94E+03	1.49E-01	3.22254	0.00615	4.9
Q.50=	1.02E+03	0.009323702	6.8324035	1.00	64.98	Q.50= 5.82E+03	7.32E-02	3.07165	0.007574	6.4	63.96	Q.50= 5.18E+04	5.74E-03	9.50315	0.00499	6.4
Q.20=	1.14E+03	0.011477014	7.8548063	1.00	102.77	Q.20= 1.27E+05	1.51E-03	11.540391	0.005742	11.0	140.19	Q.20= 3.05E+05	1.06E-03	18.2005	0.00450	5.8

Standard Error				**Flow** cfs	**Flow** cfs	Standard Error			**Flow** cfs	**Flow** cfs	Standard Error			**Flow** cfs	**Flow** cfs
December						January					February				
Q80	91.9%	to	-47.9%	81.83	22.22	Q80 90.9%	to	-47.6%	78.30	2.73	Q80 88.1%	to	-46.8%	108.10	2.63
Q50	91.2%		47.7%	124.24	95.97	Q50 88.4%		-47.7%	120.50	3.37	Q50 99.7%		-49.9%	181.88	3.23
Q20	107.0%		51.7%	212.74	155.90	Q20 89.2%		-51.7%	265.23	5.31	Q20 125.4%		-55.6%	345.37	2.56

Power	A	E	S30	F	Power	BS	S30	MCS	F	Power	MCS	F	P
March					April					May			
Q80	0.922	-1.75	0.354	0.537	Q80 -3.340	2.8	-1.52	0.795	Q80 -1.480	0.817	1.9	
Q50	1	-2.97	0.684	0.546	Q50 -2.12	2.01	-1.55	0.746	Q50 -1.49	0.862	2.13	
Q20	1.04	-3.59	0.82	0.470	Q20 -0.607	1.02	-1.57	0.57	Q20 -1.43	0.699	2.26	

March	A	E	S30	F	Flow	April	BS	S30	MCS	F	Flow	May	MCS	F	P	Flow
Q.80=	4.10E-01	266.22847	5.2E-02	2.34	6.21	82.84	Q.80= 1.17E+04	6.42E-05	823.94746	0.005175	14.939	47.99	Q.80= 1.28E+01	5.94E-03	1	9.08852	116.33
Q.50=	1.58E+00	427.00000	6.7E-03	5.16	6.40	148.83	Q.50= 9.86E+03	2.18E-03	123.93652	0.004664	12.6	157.26	Q.50= 1.38E+01	5.74E-03	1	10.263289	141.63

Q.20=	6.34E+00	544.05774	2.3E-03	7.14	4.95	286.17	Q.20=	7.66E+03	1.73E-01	11.540391	0.004352	6.9	462.56	Q.20=	1.91E+01	7.07E-03	1	6.6078047	126.21

Standard Error				Flow		Flow	Standard Error				Flow	Flow			Standard Error					Flow	Flow
March				cfs		cfs	April				cfs	cfs			May					cfs	cfs
Q80	131.0%	to	-56.7%	191.35		35.87	Q80	110.5%	to	-52.5%	101.02	22.80			Q80	151.5%		to	-60.2%	292.58	46.3(
Q50	139.1%		-58.3%	355.86		62.06	Q50	139.6%		-58.3%	376.79	65.58			Q50	180.3%			-64.3%	397.00	50.5(
Q20	132.2%		-56.9%	664.50		123.34	Q20	161.5%		61.8%	1209.58	748.42			Q20	163.9%			-62.6%	333.07	47.2(

Appendix E. Photos

Figure E1. Shoofly Creek at Bybee Reservoir Release. August 2000.

Figure E2. Shoofly Creek Upstream of Bybee Reservoir. August 2000.

Figure E3. Nickel Creek Downstream of Springs. June 2001.

Figure E4. Deep Creek (DC-001) Near Mud Flat Road. August 2001.

Figure E5. Red Canyon Creek. at Road Crossing. June 2000.

Figure E6. Red Canyon Creek. Below Road Crossing. June 2000.

Figure E7. Deep Creek near Castle Creek. June 2000.

Figure E8. Red Canyon Creek Near Road Crossing. August 2000.

Figure E9. Redband Trout Mortality, Deep Creek Upstream of Castle Creek. June 2000.

Figure E10. Long Glide Area on Deep Creek, Upstream of Castle Creek. June 2000.

Figure E11. Castle Creek Near Confluence with Deep Creek. June 2000.

Figure E12. Riffle Area on Deep Creek below Glide, Near Castle Creek. June 2000.

Figure E13. Pole Creek Near Mud Flat Road. June 2000.

Appendix F. Distribution List

Upper Owyhee Mailing List

PETE SINCLAIR
NRCS
19 REICH
MARSING ID 83639

LOWELL MURDOCK
IDAHO DEPARTMENT OF LAND
8355 W STATE ST
BOISE ID 83703

BRENDA RICHARDS
OWYHEE CO. NATURAL RESOURCE COMMITT
HC 88 BOX 1090
MURPHY ID 83650

BRUNEAU RIVER
SOIL CONSERVATION DIST.
P.O.167
345 MAIN ST.
GRANVIEW, ID 83624

JOHN CRUM
SHOSHONE-PIAUTE TRIBES
PO BOX 219
OWYHEE NV 89832

JOSEPH PARKINSON
123 W HIGHLAND VIEW DR
BOISE ID 83702

JIM DESMOND
OWYHEE COUNTY COMMISSIONERS
PO BOX 370
MURPHY ID 83650

TIM LOWERY
OWYHEE COUNTY NATURAL RESOURSE
COMMITTEE
BOX 132
JORDAN VALLEY OR 97910

LARRY W. MEREDITH
26190 MOONGLOW
MIDDLETON ID 83644

JEANNIE STANFORD
STANFORD LAND & CATTLE
CLIFFS STAGE
JORDAN VALLEY OR 97910

RIDDLE RANCHES
HC 86, BOX 37
BRUNEAU, ID 83604

GLENNS FERRY GRAZING ASSOCIATION
C/O NICK PASCOE, PRESIDENT
P.O. BOX 126
  JORDAN VALLEY, OR 97910

J.R. SIMPLOT COMPANY
HC 85, BOX 275
GRANDVIEW, ID 83624

NAHAS, R.T. COMPANY
C/O CRAIG BAKER
P.O. BOX 127
MURPHY, ID 83650

PENTAN COMPANY OF NEVADA, INC.
HC 32, BOX 450
TUSCARORA, NV 89837

BRUNEAU CATTLE COMPANY
ATTN: ERIC DAVIS
HC 85, BOX 138
  BRUNEAU, ID 83604

OWYHEE COUNTY
NATURAL RESOURCES COMMITTEE
P.O. BOX 370
MURPHY, IDAHO 83650

JOHN BARRINGER
6016 PIERCE PARK LANE
BOISE, IDAHO 83706

IDAHO RIVERS UNITED
2600 ROSE HILL
BOISE, IDAHO 83705

IDAHO CONSERVATION LEAGUE
P.O. BOX 844
BOISE, IDAHO 83701

COMMITTEE FOR THE HIGH DESERT
P.O. BOX 2863
BOISE, IDAHO 83701

WILDERNESS SOCIETY
2600 ROSE HILL
BOISE, IDAHO 83705

IDAHO DEPARTMENT OF FISH AND GAME
3101 SOUTH POLELINE ROAD
NAMPA, IDAHO 83686

OWYHEE SOIL CONSERVATION DISTRICT
P.O. BOX 486
19 REICH STREET
MARRING, IDAHO 83639

OREGON DIVISION OF STATE LANDS
A.K. MAJORS EMPIRE COOPERATE PARK
SUITE B-1
BEND, OREGON 97701

TREASURE VALLEY TRAIL MACHINE
ASSOCIATION
P.O. BOX 1913
BOISE, IDAHO 83701

IDAHO DEPARTMENT OF LANDS
SOUTHWEST AREA OFFICE
8355 WEST STATE STREET
BOISE, IDAHO 83703

WESTERN WATERSHED PROJECT
P.O. BOX 1602
HAILEY, IDAHO 83333

IDAHO DEPARTMENT OF LANDS
WINSTON WIGGINS, DIRECTOR
954 WEST JEFFERSON
BOISE, IDAHO 83702

OWYHEE COUNTY COMMISSIONERS
P.O. BOX 370
MURPHY, IDAHO 83650

IDAHO DEPARTMENT OF AGRICULTURE
PATRICK TAKASUGI, DIRECTOR
P.O. BOX 790
BOISE, IDAHO 83701

AMERICAN WHITEWATER ASSOCIATION
JOHN GANGENI
482 ELECTRIC AVENUE
BIG FORK, MONTANA 59911

US DEPARTMENT OF INTERIOR
BUREAU OF LAND MANAGEMENT
STATE OFFICE
1387 VINNELL WAY
BOISE, IDAHO 83709

US ENVIRONMENTAL PROTECTION AGENCY
1440 NORTH ORCHARD
BOISE, IDAHO 83706

THE NATURE CONSERVANCY
1109 MAIN STREET
 BOISE, IDAHO 83702

STATE OF OREGON
DEPARTMENT OF ENVIRONMENTAL QUALITY
1712 SOUTHWEST ELEVENTH AVENUE
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Appendix G. Public Comments

Comments From: Petan Ranches Received via FAX: November, 22, 2002 Received via United States Postal Service: November 25, 2002	**Response:**
1) Is the SBA-TMDL a draft or final document? Your letter of October 21, 2002 indicates that the SBA-TMDL is in the "draft" stage of development, and gives an Idaho DEQ web-address where the SBA-TMDL can be viewed. However, the October 2, 2002 SBA-TMDL document for the Upper Owyhee Watershed at the DEQ web-site states on its face that it is a Final Draft. The wed-site document was the only one available to us and was reviewed for this response. However, the question about the status of the SBA-TMDL made it unclear if we were invited to comment on the SBA-TMDL in its entirety, or just upon the SBA-TMDL findings and conclusions, we comment upon it in its entirety, including it findings, conclusions, and proposed actions.	The document is a final draft. This implies that comments on the document will be reviewed with applicable comments addressed, changes made in the document, or further explanation made to clarify.
2) Does turbidity in Juniper Basin Reservoir exceed Idaho's WQS? The SBA-TMDL claims that trubidity in Juniper Basin Reservoir exceeded Idaho's WQS on page xix of its Executive Summary and on pages 61 and 95 of the report. However, the SBA-TMDL does not report any actual measured turbidity values for Juniper Basin Reservoir, or even summarize such measurements. It should provide at least a numeric summary of the turbidity data that was collected.	Tables have been added to the document in Section 2.4 to discuss in-reservoir turbidity data. The discussion on the exceedance of the turbidity criteria has been modifies to address the narrative sediment criteria.
The turbidity WQS for Cold Water Aquatics is premised upon not exceeding <u>background levels</u> by either 50 NTUs instantaneously or 25 NTUs over a period of ten consecutive days (see October 2002 Idaho Administrative Code fir DEQ at IDAPA' 58.01.02.250.02.e, and SBA-TMDL pages 59 and 94). Thus, the Idaho turbidity WQS for Cold Water Aquatics must be evaluated in terms of how much it exceeds background levels.	The turbidity levels set in the TMDL are targets. This reference to the water quality standards for turbidity will be omitted in the final submittal document. These standards relate to point source wastewater discharges. With this in mind, background concentrations are not applicable. The Idaho WQS for sediment prohibit sediment in quantities that impair the beneficial uses for the water body. An independent analysis of periphyton (Bahls 2001) showed severe impairment to the biological community in both Juniper Basin and Blue Creek Reservoirs.
The SBA-TMDL does not determine, nor even discuss, background turbidity levels for Juniper Basin Reservoir. No conclusion can be drawn regarding whether or not Juniper Basin Reservoir exceeded Idaho WQS for turbidity until background turbidity until background turbidity levels are determined. See item 3) below for a discussion of background turbidity levels that are relevant to	As discussed above, the turbidity levels set in the TMDL are targets. This reference to the water quality standards for turbidity will be omitted in the final submittal document. These standards relate to point source wastewater discharges. With this in mind, background concentrations are not applicable.

Juniper Basin Reservoir.

3) Is the background turbidity for Juniper Basin Reservoir 0 NTUs? The SBA-TMDL concludes on page 100 that the total turbidity Load Capacities for reservoirs are 25 NTUs over ten consecutive days or 50 NTUs instantaneously. The SBA-TMDL lists these same Load Capacities for Juniper Basin Reservoir in Table 31 on page 101. The Juniper Basin Reservoir of 22.5 NTUs or 45 NTUs respectively on Pages 108-109. Consequently, the SBA-TMDL turbidity Load Capacities and Load Allocations are based upon the assumption that the background turbidity for the reservoirs is 0 NTUs. Interestingly, the SBA-TMDL acknowledges that it was developed despite a lack of data and knowledge regarding existing sediment loads on pages 105-106. Furthermore, the SBA-TMDL acknowledges that there was no data available to assess the status of existing uses for Juniper Basin Reservoir on pages xix, 42 and 44.

Petan contends that the background turbidity level for Juniper Basin Reservoir must be established before determinations of the Load Capacity for turbidity and associated Load Allocations can properly be made. Turbidity data to determine background turbidity levels associated with Blue Creek Reservoir are available bases upon turbidity monitoring conducted by Western Range Services (WRS) for Riddle Ranches, Inc. Such data demonstrates that the assumption of a 0 NTU background turbidity for Blue Creek Reservoir from 1999 through 2002. Analysis of the turbidity is about 25 NTUs in the late spring. 16 NTUs in mid summer and 7 NTUs in the fall (see Riddle Ranches, Inc.'s comment letter dated November 22, 2002). Similar background turbidity determinations should be made for Juniper Basin Reservoir.

The erosion K-Factors depicted in Figure 11 on page 83 of the SBA-TMDL show that the soils in the vicinity of Juniper Basin Reservoir are generally more erodable then those in the vicinity of Blue Creek Reservoir. Therefore, Petan expects that the background turbidity associated with Juniper Basin Reservoir is at least as high as that associated with Blue Creek Reservoir. Therefore, appropriate instantaneous Load Capacities for Juniper Basin Reservoir can reasonable be expected to be at least 75 NTUs in late spring, 66 NTUs in mid summer and 57 NTUs in fall. Also, appropriate ten-consecutive-day Load Capacities for Juniper Basin Reservoir can reasonable be expected to be at least 50 NTUs in late spring, 41 NTUs in mid summer and 32 NTUs in fall. We therefore contend that subsequent Load Allocations for turbidity need to

Table 39 shows the load capacity, or targets, for both Juniper Basin Reservoir and Blue Creek Reservoir. The reference to background levels located in Table 27 will be omitted in the final submitted SBA-TMDL. Background turbidity levels are discussed in Section 2.4.

As discussed above, the turbidity levels set in the TMDL are targets. This reference to the water quality standards for turbidity will be omitted in the final submittal document. These standards relate to point source wastewater discharges. With this in mind, background concentrations are not applicable.

See response above.

be recalculated based upon the above Load Capacities.	
Furthermore, the Margin of Safety (MOS) used for sediment in the SBA-TMDL is primarily based upon two unknowns; existing loads and current streambank erosion rates (see SBA-TMDL page 105). The determination of background turbidity levels in the above analysis helps to answer the first unknown. Therefore, the MOS for the Load Allocations should be reduced by at least half when they are recalculated.	See responses to pervious comment.
Finally, the estimated bank erosion rates for Juniper Creek shown in Table 34 (page 103 of the SBA-TMDL) are from 63 to 1,038 times greater than the target bank erosion rate shown in Table 31 (page 101). It is inconceivable to Petan that current or historic land uses could account for this magnitude of difference, particularly in light of the fact that ecological status of the associated watershed was found to be late-seral in both 1979 and 1997 meeting and going beyond BLM's Land Use Plan requirements for range conditions and trend. The target erosion rates, or the estimated erosion rates, or both, are unrealistic and should be reconsidered.	The values represented in Table 34 are gross estimates based on a streambank study conducted in an adjacent watershed with similar characteristics. The TMDL clearly states as more information is collected by land management agencies these values will be adjusted to reflect any further findings.
4) Should creeks that often go dry be required to meet temperature and turbidity standards for Cold Water Aquatics? Petan contends they should not, and contends that such creeks, including Juniper Creek, should not include Cold Water Aquatics on their lists of beneficial or existing uses. Information presented in the SBA-TMDL indicates that many of the Upper Owyhee Watershed streams currently on Idaho's "303(d)" list were found to be dry during at least some of the field monitoring conducted by the Idaho DEQ. Some of these creeks were found to be dry for a period of time in each year that monitoring was conducted by the Idaho DEQ. It is unreasonable to require that these steams achieve temperature and turbidity WQSs fir Cold Water Aquatics when the fact that they are often dry in the most significant factor limiting cold water species. Instead, the finding that these streams are often dry should be used to support a determination that Cold Water Aquatics is not a beneficial or existing use that these creeks are required to support.	**Intermittent Waters.** A stream, reach, or water body which has a period of zero (0) flow for atleast one (1) week during most years. Where flow records are available, a stream with a 7Q2 hydrologically-based flow of less than one-tenth (0.1) cfs is considered intermittent. Streams with natural perennial pools containing significant aquatic life uses are not intermittent (IDAPD §58.01.02.003.53). Since there are no historic flow data in the Upper Owyhee Watershed, streams were classified as intermittent based on USGS Topographic maps. Numeric water quality standards only apply to intermittent waters during optimum flow periods sufficient to support the uses for which the water body is designated (IDAPA §58.01.02.070.06).
5) Are the SBA-TMDL temperature targets and estimated shade requirements reasonable? Petan contends that they are not, and contends that alternative reasonable levels that can be attained should be established.	Several streams in the watershed are included in the Idaho Department of Fish and Game's Fisheries Management Plan as managed for wild stocks of redband trout (cold water aquatic life). With this

The SBA_TMDL estimates that the amount of shade required to achieve target temperature Load Capacities is often near 100% in Table 29 on page 99. In fact, the June estimates are all 87% or higher. Such high shade requirements are virtually unattainable everywhere along the stream segments listed in the SBA-TMDL. Since the shade requirements to achieve current target temperatures are unattainable, the current temperature targets are unattainable and unreasonable. The temperature targets need to be changed so that they are reasonable and attainable.

Petan reserves the right to provide comments and input during the anticipated development of implementation and monitoring plans that will affect their livestock operation (see SBA-TMDL pages xxviii and xxix).

We wish to forecast for you that Juniper Basin Reservoir is an irrigation reservoir authorized under federal grant(s).

Petan Company of Nevada, Inc.

information in mind, as well as temperature data which showed violations of the WQS for temperature, such streams must be proposed for placement on the Idaho §303(d) list.

If data exists which indicates that any of the streams we have proposed for the §303(d) list are in compliance with cold water aquatic life temperature standards, DEQ encourages public input with data to support this position during the §303(d) listing process.

Whether or not the cold water aquatic life temperature standard is attainable or not was not within the scope of this SBA-TMDL. This type of decision can only be made upon completion of a Use Attainability Analysis (UAA).

Comments noted.

Comments From: Thomas G. Skinner Received November 26, 2002	Response
I was one of the Jordan Valley livestock operators in the late 1940's. My livelihood extended into the designated area for fishing and hunting, besides riding the nearby ranges for stray cattle.	Comments noted
I was warned that I should not fish the small streams that emptied into the North Fork of Owyhee and Deep Creek after July 1. They go dry in the summer. I was warned to not fish Deep Creek in the summer as it is almost level and is hot and mossy.	Comments noted.
I am not a member of the Owyhee County Natural Resource Committee.	Comments noted.
The subject of constructing a model for this assessment process may be another bureaucratic agency program but it must contain local participation for its implementation. The plan resulting from IDEA's data collection on Pole Creek, Red Canyon, Castle Creek and Nickel Creek is questionable because of the water temperature on these small streams during late summer months.	The SSTEMP model has been used a variety of TMDLs (Rio Chamita, New Mexico; Upper Ponil Creek, New Mexico; Navarro River, California). The Ponil Creek and Rio Chamita TMDLs were the templates and format for the Upper Owyhee Watershed TMDL. All TMDLs mentioned are approved TMDL, and thus DEQ believes the model use is an appropriate technique as described in 40 CFR 130.2(g). If the commenter wishes to provide any data that would clearly dispute the use of the SSTEMP model it maybe considered in an amendment to the Upper Owyhee Watershed SBA-TMDL. Current WQS and the SBA – TMDL for these streams are based on cold water aquatic life. In order to change these standards to something less stringent a use attainability analysis (UAA) would be required.
I suggest that the federal land management agencies refrain from eliminating uses rather than collecting and analyzing the data for a plan to assist in decisions for managing the in-place allocations.	All interested stakeholders will be involved in developing an implementation plan.

Comments Received From: Idaho Soil Conservation Commission Received via: United States Postal Service: November 22, 2002	Response Date: November 29, 2002
On the basis of a thorough review by Commission staff and discussion with the SSTEMP developer, there are some concerns that need to be addressed regarding the process of developing this TMDL, and the use of shading and bank width as a surrogate for the temperature TMDL, and the use of another watershed streambank erosion raters from another watershed to allocate the sediment load allocation.	Comments noted, and will be addressed.
Regarding the use of the SSTEMP model, there is concern with its use in setting TMDL temperature load allocations. SSTEMP was developed to be used as an "exploratory" tool a land manager uses to help determine alternation solutions to improving riparian and stream temperature conditions. SSTEMP should not be used in this case to set TMDL load allocations, prescribing land management targets, such as 100% shading on specific tributaries within the watershed. While increased shading and decreased stream widths may be feasible to achieve in some areas of this watershed, it is not appropriate for the entire stream length due to stream morphology variations, hydrologic limitations, and vegetative growth capabilities. The Commission feels that prescribing specific "practices" to meet beneficial uses should not be done within the TMDL but within the context of a watershed implementation plan.	The SSTEMP model has been used a variety of TMDLs (Rio Chamita, New Mexico; Upper Ponil Creek, New Mexico; Navarro River, California). The Ponil Creek and Rio Chamita TMDLs were the templates and format for the Upper Owyhee Watershed TMDL. All TMDLs mentioned are approved, and thus DEQ believes the model use is an appropriate technique as described in 40 CFR 130.2(g). If the commenter wishes to provide any data that would clearly dispute the use of the SSTEMP model it may be considered in an amendment to the Upper Owyhee Watershed SBA-TMDL. The validation of the model located in Appendix D shows the actual water temperature data gathered in 2000 and 2001 and the predicted temperature provided by SSTEMP showed a strong validation of the model use for both maximum daily average temperature and maximum daily temperature.
While SSTEMP can, with good quality and an adequate quantity of input data, faithfully reproduce mean daily water temperatures throughout a stream reach. (Bartholow, SSTEMP 2002), its capability for accurately predicting maximum daily temperatures is (questionable?) Added by DEQ for clarity. (Bartholow – phone conversation Oct. 30, 2002).	It is clearly stated in the model calibration and validation portion of Appendix D that the maximum daily temperatures are predicted only. The SSTEMP model has been used a variety of TMDLs (Rio Chamita, New Mexico; Upper Ponil Creek, New Mexico; Navarro River, California). The Ponil Creek and Rio Chamita TMDLs were the templates and format for the Upper Owyhee Watershed TMDL, this included the prediction of maximum daily temperature. All TMDLs mentioned are approved, and thus DEQ believes the model use is an appropriate technique as described in 40 CFR 130.2(g). If the commenter wishes to provide any data that would clearly dispute the use of the SSTEMP model it maybe considered in an amendment to the Upper Owyhee Watershed SBA-TMDL. 40 FCR 130.2(g) states, " Load allocations are best estimates of the loading, which may range from reasonable accurate estimates to gross allotments,
SSTEMP is not to be used as a predictor of actual temperatures, but as a tool to compare changes in	

attributes. Maximum temperatures are least likely correct when derived from the model (Bartholow – phone conservation Oct. 30, 2002). Average temperatures are better predicted. Also SSTEMP requires more accuracy when utilizing the model to prescribe riparian vegetation manipulation. Data obtained from multiple sites within a reach is absolutely necessary when inputting the optional shading variables. The number of BURP or other data collection sites is too limited to provide any level of accurately describe current conditions within the steam reaches.	depending on the <u>availability of data and appropriate techniques</u> for predicting loading.” If the author of SSTEMP wishes to provide direct comments concerning the use of his model, those comments may be considered for amendments to the Upper Owyhee Watershed SBA-TMDL. The SSTEMP model has been used for a variety of TMDLs (Rio Chamita, New Mexico; Upper Ponil Creek, New Mexico; Navarro River, California). The Ponil Creek and Rio Chamita TMDLs were the templates and format for the Upper Owyhee Watershed TMDL, this included the prediction of maximum daily temperature. All TMDLs mentioned are approved, and thus DEQ believes the model use is an appropriate technique as described in 40 CFR 130.2(g). If the commenter wishes to provide any data that would clearly dispute the use of the SSTEMP model it maybe considered in an amendment to the Upper Owyhee Watershed SBA-TMDL.
The apparent lack of stream flow, ground water flow, or temperature data, as well as no local watershed based climatic data (such as humidity, air flow, etc.) and stream physical attributes data (such as wetted width), indicates the attempted use of this model would likely result in gross misinterpretations of existing conditions and resultant predictions through various adjustments in model inputs.	40 CFR 130.2(g) states, “ Load allocations are best estimates of the loading, which may range from reasonable accurate estimates to gross allotments, depending on the <u>availability of data and appropriate techniques</u> for predicting loading.” If the commenter wishes to provide any data that would clearly dispute the use of the SSTEMP model it maybe considered in an amendment to the Upper Owyhee Watershed SBA-TMDL. In May 2000, DEQ requested any information and data for the Upper Owyhee Watershed SBA-TMDL development. DEQ did not receive any response from the commenter. The information stated in the comments may or may not have provided further information for the model calibration. 1. Estimates of stream flow were obtained from a hydrologic model developed by the United States Geological Survey and United States Forest Service with specific application to Idaho (Hortness and Berenbrock, 2001). 2. No data was provided to DEQ that would identify ground water aquifers in the area. Ground water input is not a required input parameter for model runs. 3. Surface water temperature was provided in the document. 4. There are no climate stations in the watershed.

| | 5.   The stream's physical attributes were analyzed using available data. If other stream channel attributes are available, DEQ is willing to consider that data for an amendment to the Upper Owyhee Watershed SBA-TMDL.

The validation of the model located in Appendix D shows the actual water temperature data gathered in 2000 and 2001 and the predicted temperature provided by SSTEMP showed a strong validation of the model use for both maximum daily average temperature and maximum daily temperature. |

Also, SSTEMP does not automatically handle cumulative effects (Bartholow 2002). Changing only stream shading, "mathematically adding or deleting vegetation is not the same as doing so in real life, where such vegetation may have subtle or not so subtle effects on channel width and length, air temperature, relative humidity, wind speed, and so on" (Bartholow 2002). If one chooses to utilize SSTEMP to prescribe changes in shading, then one must also adjust the other variables that will change along with an increase of vegetation to provide a more accurate prediction.

The SSTEMP model has been used for a variety of TMDLs (Rio Chamita, New Mexico; Upper Ponil Creek, New Mexico; Navarro River, California). The Ponil Creek and Rio Chamita TMDLs were the templates and format for the Upper Owyhee Watershed TMDL, this included the prediction of maximum daily temperature. All TMDLs mentioned are approved, and thus DEQ believes the model use is an appropriate technique as described in 40 CFR 130.2(g). If the commenter wishes to provide any data that would clearly dispute the use of the SSTEMP model it maybe considered in an amendment to the Upper Owyhee Watershed SBA-TMDL.

If the TMDL load allocation process, as outlined in the draft TMDL, is to be based on a "quantity" target for temperature, while utilizing the SSTEMP model, it should be limited to setting a mass/unit/time measurement of heat in joules/meter²/second (Utilize Table 28, p. 98). The joules/ meter²/second, would not infer specific stream manipulation to meet the temperature target, such as shading. The Commission recommends that Table 29 "Shade Requirements to Achieve Load Capacity for Stream Segments in Upper Owyhee Watershed" be removed from the TMDL document and that load allocations be, at most, based on Table 28, SSTEMP's joules/ meter²/second output. Land management agencies and landowners should be allowed to determine (in the near future) what Best Management Practices are best suited to meet and support beneficial uses.

Table 28 provides the mass/unit/tame requirement for a TMDL. The measurement of joules/meter^2/second is the link for the surrogate measurement of the required percent shade to achieve the State WQS.

Regarding the Upper Owyhee sediment TMDL portion, there are also some concerns. The wide range of lateral recession rates previously estimated for the Succor Creek watershed should not be used as an example for determining this watershed's sediment TMDL load. The differences in morphological, hydrological, and other physical characteristics as well as other data in these two

This is the only available data that would offer some comparison. The streambank erosion rates for Succor Creek were placed in the document only to demonstrate the variability of streambank erosion associated with the arid deserts in southwest Idaho. In the same section the document reads, "As more streambank information is collected by land management agencies the values in Table 34 will be adjusted." If there are other streambank erosion

watersheds is too significant to provide accurate determination of the sediment load.	rates available that has specific application to the Upper Owyhee Watershed, it may be considered for an amendment to the Upper Owyhee Watershed SBA-TMDL.
	Comments noted.
Utilizing data on stream bottom percent fines may be the most appropriate choice to set sediment targets, even though data is limited to a small number of BURP sites.	
The allocation method, in which where rangeland is deemed the largest contributor of sediment, would not be appropriate unless delivery ratios have been established. According to DEQ, streambank erosion allocations (Table 42) are expected to meet in-stream TMDL targets, then upland load allocations (Tables 37, 38) would not be necessary. The sediment target load allocations on rangeland and in-stream bank erosion discussion is not clear.	Streambank erosion rates are targets that will achieve the in-stream sediment load. With no data except for those provided by the BLM through the use of the MUSLE model, it is very difficult to determine the delivery rate to water bodies.

40 CFR 130.2(g) states, " Load allocations are best estimates of the loading, which may range from reasonable accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting loading." If the commenter wishes to provide any data that would assist in determining the delivery rates from up-land erosion it maybe considered in an amendment to the Upper Owyhee Watershed SBA-TMDL. |
| If riparian areas are lumped in with rangeland for assigning the temperature load allocation, would it not seem appropriate that the same logic apply to the sediment allocations? Does this TMDL require meeting upland (rangeland) erosion allocation and in-stream bank erosion rate or just one of the two? | Table 36 will be corrected to show the total heat load will be assigned to rangeland. |

Comments From: Idaho Department of Agriculture Received via Fax Copy; November 20, 2002 Letter Dated November 12, 2002	Response November 21, 2002
We are concerned with the use of the SSTEMP model for establishing temperature loads within the Upper Owyhee system. We are submitting the following comments. Our comments also reference the letter submitted by the Soil Conservation Commission (SCC)(Jerry Nicolescu, October 30, 2002). Our concerns are similar to the SCC concerns about stream flow model being used to predict minimum stream flows along with loads for sediment within the Owyhee System.	Comments noted and will be addressed in the response to comments received from the Idaho Soil Conservation Commission.
As stated on page 101, Section 5.3 Estimating of Existing Pollutant Load. Regulations allow that loading "may range from reasonable accurate estimates to gross allotments depending on the available data and the appropriate techniques for predicting the loading (40 CFR § 130.2(I)). The key words in this comment are appropriate techniques, which ISDA feels is not available for this loading analysis. Also this quote could not be located within the referenced CFR.	The citation should read CFR §130.2 (g) and will be corrected in the Upper Owyhee Watershed SBA-TMDL document. The use of the mentioned hydrologic model is a peer-reviewed document. The model and the corresponding document clearly state the limitations of the document. However, it is DEQ's belief that the use of the streamflow model is an appropriate technique. It is recognized that the model has limitations. Through a literature search, it was determined that this flow model is the only model with specific application to this area in the state of Idaho. If there is another hydrologic model available or data to assist in validating the model runs that has a specific application to the Upper Owyhee Watershed, it may be considered for an amendment to the Upper Owyhee Watershed SBA-TMDL.
A TMDL is a legal document that applies those pollutant load reductions requirements on water bodies. A TMDL whether on public, private, state or federal lands require these reductions be met by implementing BMP activity within the TMDL watershed. These reductions should not be gross allotments or developed with models that do not distribute a fair reduction allocation to property owners. Unfortunately, the stream flow model that was used for load allocations does not function well for the Owyhee area (Region 7). The author of the model states, "Although the SEE of estimating equations for regions 6 and 7 generally were significantly larger than those for other regions, the natural variability of streamflow in regions 6 and 7 is also significantly greater in the other regions as a result of more sporadic and generally less precipitation (Mounau 1995). Prediction of streamflow statistics that have a high degree of variability will have more uncertainty than	It is agreed that the flow model used has limitations, especially for sections in southwest Idaho. An effort was made to validate the model for the Upper Owyhee Watershed. However, without some long term, or even short term, historic flow data this proved impossible. A comparison with this watershed to other watersheds in surrounding HUCs was attempted. This also proved to be extremely difficult because lack of similar physical and meteorological characteristics (i.e. elevation changes, drainage areas, land use, precipitation) between paired watersheds. If there is another hydrologic model available that has a specific application to the Upper Owyhee Watershed, it may be considered for an amendment to the Upper Owyhee Watershed SBA-TMDL.

prediction of statistics that are more stable."
In addition, the models reliability and limitations might not be reliable for sites where the basin characteristics are outside the range of characteristics that were used to develop the equations (table 11 within model document). The model also states that the using basin characteristic values near their extremes (maximum or minimum table 11) might result in unreliable and erroneous estimates. It was not well defined within the TMDL document which model input parameters were utilized. If the input parameters are near the extremes, as stated in the model, then when other input values are added to the model then the results could be further skewing of the results. An explanation of the model use and validation is not located in Appendix D as stated in the TMDL document.

It is agreed that some of the watershed's physical characteristic parameters were usually less than the minimum extremes, mainly basin relief values. However, the input value for basin relief was not used in the calculations to determine the flows.

As an example: For Juniper Basin, the only input parameters that would have been below the minimum value to put into the model were basin relief (BR). This value was not used for any of the flow calculations for any months where estimated flows were calculated.

The model's documentation's states, …the equations might not be reliable for sites where the basin characteristics are outside the range of characteristics that were used to develop the equations." The documentation also states, "Using basin characteristics values near the extremes might result in unreliable and erroneous estimates.

DEQ recognizes that Appendix D did not contain all the information. On discovering this error, a copy of the model spreadsheets was electronically sent to the commenter's agency.

Another concern with the USGS model has to do with estimating the low streamflow statistics (80 percent exceedance) that are used to predict loads within the Owyhee watershed. In general, the equations are more reliable for estimating high streamflow statistics (20 percent exceedance) than estimating low streamflow statistics (80 percent exceedance in any given month). It appears from the author's comments that the degree of error is much larger when using this model in Idaho Region 7 and with the Q.80 flow estimates. Considering the large standard estimated error (SEE) shown in Table 9 of the model, for June, July and August, it appears that this model will be ineffective in accurately predicting discharge rates and load allocation for the Upper Owyhee TMDL.

The Q.80 value obtained by the model was used to determine the critical conditions. It is agreed that the flow model used has limitations, especially for sections in southwest Idaho. If there is another hydrologic model available or available flow data that has a specific application to the Upper Owyhee Watershed, it may be considered for an amendment to the Upper Owyhee Watershed SBA-TMDL.

The values found in Table 34 of the TMDL document are based on streambank erosion rates that where identified for Succor Creek in southwest Idaho. The erosion rate of 13.04 to 214.8 tons/mile/year (Horsburgh) was used for estimating bank erosion rates for the Upper Owyhee watershed. Are these two watersheds that identical in hydrology and geology to allow estimated erosion rates from Succor Creek watershed to be transferred to the Upper Owyhee watershed? An erosion rate of 13 to 215 tons/mile/year seems to have a very high level of uncertainty for estimating bank erosion rates. Table 34 lists the methods of erosion

This is the only available data that would offer some comparison. The streambank erosion rates for Succor Creek were placed in the document only to demonstrate the variability of streambank erosion associated with the arid deserts in southwest Idaho. In the same section the document reads, "As more streambank information is collected by land management agencies the values in Table 34 will be adjusted." If there is other streambank erosion rates available and has a specific application to the Upper Owyhee Watershed, it may be considered for an amendment to the Upper Owyhee Watershed SBA-TMDL.

estimation based on probable bank erosion yields 18214 tons/mile. Where did these numbers come from?	The reference to the 18214 (18-214) figure is a typo error. The value should be the 13-214 tons/mile value stated on the previous page in reference to the Succor Creek study. This will be corrected for the final document.
Overall this TMDL is fully of estimations based on uncertain modeling with no real data to base any of the loading assumptions on. When models are used they require solid data inputs to insure the model projections are within the parameters of the real world. Without solid data the validation of the model is impossible and overall results are not scientifically valid. It is unfortunate that the Upper Owyhee TMDL cannot be delayed until real data is available to formulate a proper TMDL load for temperature and sediment. Without solid load reduction numbers it will nearly impossible for land management agencies and private property owners to install proper BMPs to reach the goal of the Clean Water Act.	40 CFR 130.2(g) states, "Load allocations are best estimates of loading, which may range from reasonable accurate measurements to gross allocations, depending on the availability of data and appropriate techniques for predicting the loading."

With the resources and timeframe available to develop this TMDL, DEQ believes that appropriate techniques were used to determine load allocations for the Upper Owyhee Watershed. As stated through out the TMDL portion of the document, the values presented are gross estimates and as more information is collected then modifications to the TMDL will occur and values may be amended. |

Comments From: Committee for the High Desert and Western Watershed Project Received via E-mail; 11-10-02	Response: 11-15-02
The document suffers from glaring omissions, and a lack of solid data for decision making on many components of the Assessment/TMDL process.	Comments noted.
We refer to you to a large array of data collected by BLM in the Nickel Creek, Trout Creek, Castlehead-Lambert, Bull Basin and other Fundamentals of Rangeland Health determinations and grazing assessments that document widespread ongoing harmful livestock grazing impacts to the watersheds covered in this EA. You primarily discuss BLM fish data in the DEQ report. You must include the overwhelming body of evidence in these BLM documents that point directly to livestock grazing as the cause of watershed-level devastation here.	The Bureau of Land Management's (BLM) Environmental Assessments (EA) mentioned discuss land management objectives which include the overall goals of the Idaho Rangeland Standards and Health Guidelines. One of these goals is the compliance with Idaho Water Quality Standards. However, these EAs offer no new water quality data that will alter the SBA-TMDL conclusions.
For ALL data discussed or analyzed in your assessment, please provide information on whether livestock grazing was occurring during the period when the data was collected.	This type of information is not a component of the monitoring plan (Ingham 2000) and was not documented. Livestock grazing is a land use in the watershed.
Sediment - You have not examined these streams during periods of the year when they are chock-full of sediment, and the water is muddy brown. You complain that these lands are inaccessible û yet the Mud Flat road is often drivable in March, and certainly in April. We have specifically told you in other TMDL processes that to adequately assess sediment, you need to examine sediment at that time, not during low flows in mid-summer, or during summer periods before livestock are grazing in an area.	One of the goals of the SBA was to determine the water quality status with regard to the listed pollutants. The available data was used to establish load reductions where applicable. The state water quality standards have provisions that preclude sediment in quantities, which may impair designated beneficial uses. Improved bank stability and riparian vegetation, as is recommended in the document, will decrease sediment loads during high flow events.
Of particular interest to you should be the BLM data that shows ongoing failures by the livestock industry in nearly all Owyhee grazing allotments to meet stubble height and trampling objectives. Stubble heights were put in place to protect ongoing IRREPARABLE livestock damage to streams. Violations of these court-ordered terms means that streams suffer widespread erosion during runoff periods. This runoff sweeps soils and abundant livestock waste in to waters of the TMDL area. It is essential you examine and collect data on sediment and other pollutants during runoff for all streams where you have determined, based on your inadequate sampling effort, that streams are not being impaired by sediment.	The Bureau of Land Management's (BLM) data offer no new water quality data that will alter the SBA-TMDL conclusions. If data becomes available that indicates sediment impairment of streams, DEQ will consider this information for future assessment and TMDLs, if necessary. The BLM has the proper authority to enforce the terms of grazing allotments.

As a simple method of verifying whether there could possibly maybe just might be some severe sediment problems in these watersheds during runoff, we suggest you talk to kayakers who float Deep Creek and the East Fork. Ask them what color the water is. Examine photos they might have taken. Or rent a small plane, and fly over these canyons in spring and photograph the chocolate water.

The only method to determine whether or not aesthetics are meeting the intent of the state water quality standards is through complaints received. To date, we have not received complaints concerning the aesthetic quality of the Upper Owyhee watershed. DEQ encourages public input such as this during the §303(d) listing process.

Your assessment inadequately addresses the role of ephemeral and intermittent streams in carrying sediment and other livestock û caused pollution into the streams assessed. Many of these streams are intermittent only because of livestock damage û and during spring runoff periods carry high volumes of sediment and other pollutants (livestock waste) in their flowing waters.

One of the goals of the SBA was to determine the water quality status with regard to the listed pollutants. The available data was used to establish load reductions where applicable. The state water quality standards have provisions that preclude sediment and bacteria in quantities, which may impair designated beneficial uses. Improved bank stability and riparian vegetation, as is recommended in the document, will decrease sediment loads during high flow events. Based on the available data, bacteria concentrations were not found in violation of state water quality standards.

Your assessment places overwhelming evidence on aquatic organisms as a measure of sediment. These can not be a surrogate for collection of a much broader array of data that needs to be collected under specific EPA and other protocols that have been established for sediment TMDLs.

DEQ's current policy is to use the Water Body Assessment Guidance II (January 2002) and all other available data. This process is accepted by the EPA for TMDL development. Improved bank stability and riparian vegetation, as is recommended in the document, will improve water quality and restore beneficial uses.

Given the lack of adequate data, we believe it is premature to de-list ANY streams for sediment, and that numerous streams (all tribs., East Fork Owyhee) should be added to the list for sediment and temperature based on the data that you have assembled.

The subbasin assessment (SBA) addresses only the water bodies listed on the 1998 §303(d) List. Based on the available data, several segments were recommended for de-listing because they were not found to be impaired by sediment. If data exists which indicates all tributaries and the Owyhee River are impaired, DEQ encourages public input with data to support this position during the §303(d) listing process.

Bacteria: You have utterly failed to collect adequate bacterial pollution data on all streams in the assessment area. This can only be seen as an attempt by your office to cover up the extreme levels of livestock pollution of springs, seeps and streams in these watersheds. In the North Fork Owyhee TMDL, you collected 3 one point in time bacteria samples INSIDE an exclosure. You have done almost the same thing here--with 3 one point in time samples in Battle Creek, with at least one, and possibly two of the three samples, being located inside an exclosure. This exclosure, that encompasses the confluence of Big Springs and Battle Creeks, is the largest exclosure in the entire

Bacteria sampling was conducted on those water bodies where bacteria was a listed pollutant. Based on the sampling performed, no exceedences were found. Samples were taken in the exclosure area near Twin Bridges as well as below private land at a site know as the Upper Crossing. If data exists which indicates that Battle Creek is impaired by bacteria, DEQ encourages public input with data to support this position during the §303(d) listing process.

Lower Snake River District û and may be the largest official exclosure on any of the 11.8 million acres of Idaho BLM lands. Following this magnificent effort, you proclaim that you are de-listing Battle Creek for bacteria. This must be corrected in the final document, and you cannot de-list Battle Creek for bacteria based on this sapling. In order to properly assess impairment and exceedences for bacteria, you must collect data during the period, and in areas where, livestock, the source of bacterial problems throughout these watersheds, are present. Collection of water samples inside exclosures as a basis for de-listing of streams is inexcusable, unscientific, and reveals the profound livestock industry biases that pervade this assessment/TMDL.

We request that, before you prepare a Final Assessment/TMDL for these watersheds, you collect bacterial data in all streams. As bacteria and livestock fecal matter can contribute to algal growth, brownness, murkiness and other factors that cause turbidity and sediment impairment, it is essential that you do this - even on streams that have not been listed for bacteria so that you can better understand the contribution of these pollutants.

| | Additional bacteria monitoring will be conducted with scheduled Beneficial Use Reconnaissance Program (BURP) monitoring. Future monitoring for bacteria will also in all likelihood be an element of the implementation plan for the Upper Owyhee watershed. |

Page xv states: "for those streams listed as not supporting primary and secondary contact recreation due to the presence of bacteria, monitoring has indicated those streams are full support." This statement and conclusion must be stricken from the final report, as it is based on completely insupportable and unscientific methodology as described above.

Bacteria sampling was conducted on those water bodies with bacteria listed as a pollutant of concern. Current bacteria monitoring protocol is to take one sample, and if that sample exceeds the criteria, then additional samples would be required. Since no single sample exceeded the criteria, no additional samples were required (IDEQ 2001). If data exists which indicates streams in the watershed are impaired by bacteria, DEQ encourages public input with data to support this position during the §303(d) listing process.

Aesthetics. We ask that you include an analysis of livestock-caused water quality impacts to all water bodies analyzed in this assessment. We have observed firsthand the disgusting, stinking, polluted waters of each of these streams. While such stench and ugliness may be characteristic of a Caldwell feedlot, it is not appropriate in wild lands, WSAs, ACECs, etc. Your analysis is devoid of a consideration of water quality problems impairing values of WSAs and other nationally significant wild lands here. You repeatedly refer to a reference by Allen et. al. in 1993 that is a study examining redband trout populations and where other stream data û including water quality data was collected. I (Fite) participated in the field work for that study, and can assure you that nearly all locations sampled had wretched water quality -- including abundant

Aesthetic values are protected under the General Surface Water Criteria (58.01.02.200.01.09). The presence of considerable algae growth in Deep Creek initiated a need for dissolved oxygen monitoring. Based on the data collected, dissolved oxygen will be recommended as a pollutant for the next §303(d) listing cycle for Deep Creek. Any other data submitted to DEQ will be evaluated through the Water Body Assessment Guidance to determine support of beneficial uses and future listing on the §303(d) List. To date, we have not received complaints concerning the aesthetic quality of the Upper Owyhee watershed. DEQ encourages public input such as this during the §303(d) listing process.

algae "slime" and manure, and extensive grazing and trampling damage. In all streams I have re-visited in recent years, these conditions persist.

Page xxiv refers to BLM bacterial samples. Please provide a complete list of all data related to these and any other samples as an appendix in the final TMDL.	Table B on page xxiv is in reference to Bureau of Land Management (BLM) temperature data for Battle Creek. The reference to this data and other BLM temperature data will be listed in the final document in appendix C.
Springs and Seeps. You have failed to include data, as from the 2001 Columbia spotted frog report, that documents ongoing destruction of beaver ponds and many photos that depict widespread grazing damage to wetlands, including springs and seeps and tributary drainages in the assessment areas. We note that springs, seeps and smaller drainages here are critically important to spotted frogs -- yet you have failed to analyze data for any of these in your assessment. It is essential that you do so û as these areas are critical to a broad array of native wildlife and aquatic species, and they are overwhelmingly impacted by livestock grazing damage. Plus, analysis of springs, seeps and intermittent drainages is necessary to understand the temperature and sediment problems that you have documented to be plaguing these watersheds.	Amphibians are recognized in the Water Body Assessment Guidance as aquatic species that will be factored into the assessment of fish populations. If data becomes available that indicates impairment of intermittent streams, DEQ will consider this information for future assessment and TMDLs, if necessary. DEQ encourages public input such as this during the §303(d) listing process.
Please provide a rationale for your methods (or lack thereof) of data collection here.	DEQ does not currently have a protocol for monitoring springs, seeps and intermittent streams.
We believe the final TMDL, and the next impairment/303(d) list, must include the following drainages for the following water quality impairment/ pollutants: East Fork Owyhee River, Paiute Creek, Deep Creek, Thomas Creek, Little Thomas Creek, Smith Creek, Little Smith Creek, Pole Creek, Camel Creek, Camas Creek, Dry Creek, Beaver Creek, Castle Creek, Nip and Tuck Creek, Hurry back Creek, Stoneman Creek, Current Creek, Dons Creek, Corral Creek, East and West Fork Red Canyon Creek, Pete's Creek, Nickel Creek -- all listed for sediment, temperature, flow alteration, aesthetics, bacteria.	Some of the mentioned water bodies have been recommended as water quality limited and will be considered for placement on the next §303(d) list. If data exists which indicates these streams are impaired by these pollutants, DEQ encourages public input with appropriate data to support this position during the §303(d) listing process.
Algae, Dissolved Oxygen. Your TMDL fails to examine the impacts of algae growth in late summer on water quality in nearly all streams. This is a big oversight. Data must be collected during periods of maximum algal blooms so that you understand pollutants/impairment at levels that "make or break" survival of native salmonids and other aquatic organisms.	The presence of considerable algae growth in Deep Creek in mid to late summer initiated a need for dissolved oxygen monitoring. Based on the data collected, dissolved oxygen will be recommended as a pollutant for the next §303(d) listing cycle for Deep Creek. If data exists which indicates streams are impaired by excessive algae, DEQ encourages public input with appropriate data to support this position during the §303(d) listing process.

In order to fully consider and assess the appropriate controls and develop appropriate pollution control actions in the Upper Owyhee watershed to limit pollutant loads, you must first adequately and honestly address the causes of pollution.	Rangeland was identified as the dominant land use and allocations were established for this use. Source identification was based on the rangeland land use. Rangeland as defined in Webster's Ninth New Collegiate Dictionary as: land used or suitable for range. Range as defined in the same publication as: an open region over which animals (as livestock) may roam and feed.
We also request that you analyze water samples from small streams, reservoirs and springs and seeps for hormones and other chemicals stemming from growth implants in cattle. This is necessary, as these chemicals in even minute concentrations, can effect aquatic organisms.	If data exists which indicates streams are impaired by hormones and other chemicals stemming from growth implants in cattle, DEQ encourages public input with appropriate data to support this position during the §303(d) listing process.
We have e-mailed you on your Website, when requesting this TMDL. In that request, we asked that you hold a meeting on this TMDL in Boise. You are holding two meetings in the livestock industry towns in Owyhee County, yet have failed to schedule a meeting where the recreational public and other non-extractive users of these lands live. We reiterate that request here.	E-Mail was sent to commenter on November 14, 2002 and stated: Thank you for your comments on the Upper Owyhee SBA and TMDL. We have chosen not to have another meeting. However, we could meet with you in our offices and go over the information provided in the other two meetings. Please let us know if you are interested in this arrangement.
Specific comments:	
p. 11. Paiute Creek is a horribly degraded watershed that during brief spring runoff periods delivers sediments and livestock waste to the main Owyhee River. We have seen no evidence in this report that supports its non-listing.	If data exists which indicates Paiute Creek is impaired by sediment and bacteria, DEQ encourages public input with appropriate data to support this position during the §303(d) listing process.
p. 17. You state that Blue Creek Reservoir was constructed in 1935 and is privately owned, but is entirely on lands managed by BLM. Please explain this.	Water release is managed by the private landowner that may have water rights from the reservoir. The Idaho Department of Water Resources (IDWR) 1971 identified the dam as constructed in 1935 by private resources.
p. 17. Why was Nickel Creek not evaluated below Mud Flat road? There is a large drainage area here, and it is very damaged by livestock. How can you do a TMDL/assessment for the Deep Creek watershed and not assess the greatest length of an important and degraded tributary?	Deep Creek was assessed from the headwaters to the mouth. If data exists which indicates Nickel Creek below Mud Flat Road is impaired, DEQ encourages public input with appropriate data to support this position during the §303(d) listing process.
p. 17 makes passing reference to the existence of springs and seeps -- yet no analysis of any kind has been undertaken here. They are important, often headwater sites. Although flow may be discontinuous in some areas, many have continuous flow in runoff periods.	Page 17 is in reference to the hydrology of the Upper Owyhee Watershed. DEQ does not currently have a protocol for monitoring springs, seeps and intermittent streams. As such, resources were not allocated to evaluate springs and seeps as pollution sources.

p. 18. What are the land use practices causing incised stream channels? Your explanation here is laughably limited -- that the loss of beavers is responsible for the problems afflicting these watersheds. In many of the watersheds, any beaver that tried to live here in 2002 would starve to death, as wanton livestock abuse has stripped vegetation necessary to keep beavers from starving to death.	Our interpretation of the information provided on page 18 is that stream downcutting begins with the removal of beavers from the watershed. Current land use practices have complicated the situation by removing riparian vegetation.
You cite Dupont 1999a and Thomas et al 1998 as support for the sweeping contention that lack of beavers is the fundamental problem here. Review of the bibliography shows that Dupont (perhaps associated with IDL -- an agency widely known for disastrous management of livestock and covering up for the livestock industry) wrote a Memo that you use as a basis for your glaringingly unscientific and unprofessional discussion of causes of pollution and impairment here.	The discussion of beavers in this section is to address the hydraulic modifications that have probably occurred in the watershed over the last 200 years. Section 3.2 does describe in greater detail the overall impacts that the loss of the beavers and the loss of vegetation can have on the hydrology of a water body.
The Thomas source is a general "circular" on ground and surface water, and can not be used a basis for claiming that lack of beaver is the cause of current impairment of these livestock-trashed Owyhee drainages.	Thomas et al. (1998) is a reference to discuss the interaction between surface and ground water. The reference is to demonstrate that ground water-surface water interface is an important component for stream water temperature.
p. 29 claims that western juniper has invaded large areas of the SBA. Please provide comprehensive data to support this assertion. If an invasion has occurred -- what has been the cause?	The word "large" is not used in the discussion of juniper invasion. The source for the reference of the invasion of juniper species is the BLM's Owyhee Resource Management Plan (1999). The current invasion is cited on page 29 and referenced to Bedell et al. (1991).
You fail to discuss the growing problems with weeds in the assessment area. We refer you to BLM's current Nickel Creek allotment assessment, where the invasion of burned areas in TMDL area lands by shallow-rooted cheatgrass and other weeds, and their deteriorated post-burn condition, is discussed.	The presence of cheatgrass will be acknowledged in section 1.2 of the SBA.
Here, as innumerable other Owyhee places referenced in the assessment, what are the "past and current land uses" that have altered vegetation composition in many areas? Martian spaceships landing? Cows??? Choose one. Please explain how grazing as a land use causes the damage documented in the assessment/TMDL.	The reference is to the loss of near surface ground water, which reduces the presence of hydrophilic species that require the near surface ground water. The hydraulic modifications referenced the down cutting on the wet meadow type channels. Further discussion of hydraulic modifications is found in section 3.2.
Your assessment completely lacks any assessment of hydrology/hydrological processes in old growth western juniper communities. As you refer to an invasion of hydrophobic species to the water's edge in upper portions of Red Canyon, Deep and Pole Creeks û you must also recognize that there are	It is agreed that more studies must be completed on the question of Western juniper in the Upper Owyhee Watershed. In many scientific journals the extent of juniper expansion is debated in many areas on southwest Idaho and eastern Oregon. However, it is generally agreed that Western juniper primary

important old growth juniper woodlands here, with hydrology that needs to be fully understood. Plus, if junipers are now growing in former wetland sites -- there is a cause - and that cause is ongoing livestock degradation (grazing and mechanical trampling damage) to these wetlands. Raising the water tables by controlling/eliminating grazing is the essential first step in repairing these sites. Until that is done, it is only the root systems of junipers that in many places provide any structural stability/resistance to massive erosion in these damaged watersheds.	habitat is associated with rocky crag areas where wild-land fire plays a less important role than in the shrub-lands of the sage brush/steppe areas. It is also recognized the frequency of ground fires in these areas were, at one time, a critical component for maintaining climax species associated with the sagebrush/steppe vegetation communities.
p. 30 specie???	This will be changed to "species."
p. 30. Please provide this and all other BLM fish data in appendices to the final document.	DEQ will provide a copy of this data upon request.
p. 32. Please refer to the 2001 spotted frog report to document current rancher destruction of beaver dams in these TMDL watersheds.	Amphibians are recognized in the Water Body Assessment Guidance as aquatic species that will be factored into the assessment of fish populations. If data becomes available that indicates impairment of intermittent streams, DEQ will consider this information for future assessment and TMDLs, if necessary. DEQ encourages public input such as this during the §303(d) listing process.
p. 33 Please provide the names of the large corporations and grazing associations you refer to here, and provide maps showing the land areas impacted by their activities, and the current condition of the watersheds in these areas. We note that Owyhee ranchers form grazing associations to circumvent paying a surcharge fee for running someone else's cattle on BLM lands. We also note that general lawlessness, trespass and failure to abide by any standards of use is the norm on BLM lands throughout the assessment area. You should also review agency trespass files in order to understand the difficulty of regulating grazing under the current scenario.	Your comments are noted.
p. 41. Please consider our preceding comments to be a "formal complaint" about livestock impairment of aesthetics in all waters in the TMDL. All assessment-area streams should be listed for aesthetics. You have now received a formal complaint! Please let us know if we need to provide more information.	Aesthetic values are protected under the General Surface Water Criteria (58.01.02.200.01.09). DEQ encourages public input such as this during the §303(d) listing process.
p. 43. Why were many of the existing uses in this table "not evaluated"? Does DEQ blindly close its eyes to water quality problems other than those specifically identified on the 1998 303(d) list? DEQ makes a very big deal about the remoteness and long distances to some of these sites. Given this situation, it would be in the interest of taxpayers if	An explanation of the existing use determination is located on page 42. DEQ applies the most stringent criteria to determine support status. If a water body has an existing use (i.e. cold water aquatic life) then the WQS criteria to determine compliance with that use is applied. Cold water aquatic life criteria is the most stringent (for aquatic life uses) with regards to

DEQ maximized its time afield, and conducted a complete and thorough "look" at all water quality impact while it was out there.	temperature, dissolved oxygen, pH, dissolved gases and other criteria Bacteria sampling was conducted on those water bodies with bacteria listed as a pollutant of concern (IDEQ 2001). Other water bodies not listed for bacteria did not receive bacteria monitoring due to restraints in holding time (24 hours) and was not built into as a component for monitoring (IDEQ 2001).
Could you explain how the presence or absence of salmonids in a stream effects DEQ's evaluation/analysis/assessment? We are confused. If a stream is listed and is supposed to have salmonids, or recently had salmonids but now they are gone, does this effect the analyses undertaken?	The first component of the SBA is to determine the existing uses of a water body (page 42). For many of the water bodies in the Upper Owyhee Watershed the Idaho Department of Fish and Game (IDFG) has management objectives to manage these water bodies (Deep Creek and Battle Creek) for wild-stock redband trout, which includes the self propagation of that species. The second step is to determine if that use is supported. This step examines historic fish and other biological data, along with compliance with narrative and numeric criteria set in the WQS. The final step of the SBA is to determine if the pollutant(s) of concern are impairing the existing uses.
p. 44. Both Blue Creek Reservoir and Juniper Basin Reservoir are vile hideously polluted, discolored, algae filled waters surrounded by voluminous amounts of livestock waste. In 1998, while employed by IDFG, I was involved in a sage grouse trapping effort in the vicinity of Riddle, and initially attempted to camp by Blue Creek Reservoir in September. It was such a squalid, polluted, leech-filled mess that we did not want our dogs drinking the water, and relocated. Aesthetics and wildlife uses are definitely impaired here! I have repeatedly observed cattle standing knee-deep in the brown murk of Juniper Basin Reservoir, inevitably depositing waste directly into these waters.	Comments noted.
We ask that you contact the IDFG vet at the Caine vet lab in Caldwell. There is an IDFG analysis of extensive water quality data collected as part of a spotted frog study in the Owyhee uplands that we ask you to review here, and include this data on the extreme pollution levels found in these Owyhee Upland water samples, and incorporate it into this assessment. This data demonstrates that springs, seeps, headwater streams are being grossly polluted by livestock fecal material. It is precisely these headwater streams and other water bodies where declining species of native wildlife like sage grouse	Amphibians are recognized in the Water Body Assessment Guidance as aquatic species that will be factored into the assessment of fish populations. If data becomes available that indicates impairment of intermittent streams, DEQ will consider this information for future assessment and TMDLs, if necessary. DEQ encourages public input such as this during the §303(d) listing process.

must drink. In many instances, they are drinking a slurry of cow manure, urine and probable excreted hormones. Sage grouse, migratory birds, antelope and other native wildlife do not wade into flowing water to get a drink -- instead, they drink from pond or spring margins û which are the most grossly polluted areas. If DEQ is to honestly assess impairment for beneficial uses by wildlife, recreationalists dogs, etc. MUST sample water in these locations.	
p. 44. Deep Creek is floated by kayakers, and must have a designated beneficial use for primary and secondary contact human recreation. This activity has been occurring for over a decade, and you must include this use for Deep Creek. The TMDL statement that "Deep Creek does not have designated beneficial uses except for water supply, aesthetics, and wildlife habitat", and "there is no indication that these uses are impaired" demonstrate DEQ's failure to adequately collect data on the streams covered by this assessment/TMDL.	The SBA (Table 23) recommends that primary contact recreation as a designated beneficial use for Deep Creek. If data becomes available that indicates impairment of Deep Creek for contact recreation, DEQ will consider this information for future assessment and TMDLs, if necessary. DEQ encourages public input such as this during the §303(d) listing process.
ALL streams with fish, or where there are supposed to be fish which have recently disappeared due to pervasive livestock damage, must also have a designation for primary and secondary contact recreation as anglers come in contact with these waters.	The SBA (Table 23) recommends designated uses for water bodies in the Upper Owyhee Watershed.
p. 47 states that EPA "does not believe that flow, or lack of flow is a pollutant". However, if you are to honestly assess wq impacts here, you must consider the causes and impacts of reduced flow in exacerbating wq impairment. For example, if stream flow is greatly reduced due to irrigation diversion or livestock destruction of a watershed, then pollutants will be more greatly concentrated in less volume of water than they would be in a healthy watershed, or water was not diverted. Algal growth, temperature increases, DO, elevated bacteria levels, are all exacerbated by low flows. These low flow times are also the most critical for aquatic species, as well as wildlife dependent on these waters for drinking.	Comments noted. Please refer to Section 502(6) of the Clean Water Act.
p. 47. Castle Creek, and all streams considered in this TMDL need to have recreation standards/designations of beneficial use. These include PCR, CWAL, water supply, aesthetics, wildlife habitat.	The SBA (Table 23) recommends designated uses for water bodies in the Upper Owyhee Watershed.
p. 49 states that Red Canyon Creek is "the only listed segment that has established designated uses". We ask that you carefully review the extensive data in LSRD BLM files about the livestock damage to this stream in the Trout Springs allotment	A temperature TMDL was developed to address the designated uses in Red Canyon Creek. If data becomes available that indicates impairment of Red Canyon Creek, DEQ will consider this information for future assessment and TMDLs, if necessary.

(headwaters of Red Canyon Creek), and Bull Basin allotment. BLM has a utilization cage in the West Fork of Red Canyon Creek, and has been collecting stubble height and other data on livestock damage here for approximately five years. We have frequently visited this site, which most closely resembles a feedlot.It is abundantly clear that these beneficial uses are being impaired.	DEQ encourages public input such as this during the §303(d) listing process.
This site is relatively easy to get to, and your failure to collect bacteria samples in this stream segment is indefensible.	Bacteria is not a listed pollutant of concern for Red Canyon Creek and thus did not receive bacteria monitoring. If data becomes available that indicates impairment of Red Canyon Creek, DEQ will consider this information for future assessment and TMDLs, if necessary. DEQ encourages public input such as this during the §303(d) listing process.
p. 52. While you discuss DO and "nuisance aquatic growth", you rarely quantitatively or qualitatively assess these in this document. A few photographs of green slime pools of water, or algae-encrusted rocks in September in Pole Creek, for example, and which are very common in the TMDL area, would be a good idea.	Comments noted.
p. 59. This document discusses narrative sediment criteria and numeric turbidity criteria as a method of determining violations of wqs. Where in this document are narrative sediment analyses for each stream presented? Where are all of the numeric turbidity data presented? When were these data sets collected? What criteria do you use in a narrative sediment assessment?	Section 2.3 (Sediment) discusses the biological indicators found, or not found, for each stream that has sediment listed as a pollutant of concern. Tables 17 and 18 shows the criteria used to determine whether sediment is impairing the existing uses.
p. 63. You refer to redband trout observed in 1993 in lower Red Canyon Creek, yet elsewhere you state that Red Canyon Creek dried up in a recent year. What were the wq conditions for trout left in pools during this dry period?	These pools were not evaluated and will be recognized as a data gap.
We do not understand how you determined that sediment is not a limiting factor in Red Canyon Creek. You appear to have only analyzed percent fines, and not bedload sediment during periods when livestock are present in a stream reach, or when runoff is occurring. Livestock loitering by streams in the Owyhees typically disturb banks and bottom sediments, and a large amount of water murkiness results. Thus, unless you collect data during the period when livestock are present and greatly disturbing the streambanks and waters, you can not understand impairment factors.	To determine compliance with the general water quality criteria for sediment (IDAPA §58.01.02.200.08) biological indicators were evaluated. In the case of Red Canyon Creek, macroinvertebrate and periphyton samples were used to determine the status of beneficial uses. These samples did not indicate sediment was impairing the biological communities. Historic fish data also indicated that cold water aquatic life and salmonid spawning was present with a diverse age class of salmonid species.
p. 64. Why did you look for percent fines/sediment in a reach of Red Canyon Creek with high gradient only? The lower reach, where rbt are known to be	To determine compliance with the general water quality criteria for sediment (IDAPA §58.01.02.200.08) biological indicators were

present (p. 64), is a lower gradient. You can not use your flawed data collection procedures as a basis for concluding that this stream should be de-listed for sediment.	evaluated. In the case of Red Canyon Creek, macroinvertebrate and periphyton samples were used to determine the status of beneficial uses. These samples did not indicate sediment was impairing the biological communities. Historic fish data also indicated that cold water aquatic life and salmonid spawning was present with a diverse age class of salmonid species.
p. 64. Please review data in IDFG report (Allen et. al. 1993) for lower sections of Nickel Creek. I was present on these surveys, and livestock grazing is contributing to significant algal growth stench, sediment/turbidity/discoloration of water, and impacts to riparian vegetation were observed. You must assess the entire drainage, as it makes no sense whatsoever to only examine the upper portion of this Deep Creek tributary.	If data becomes available that indicates impairment of Nickel Creek, DEQ will consider this information for future assessment and TMDLs, if necessary. DEQ encourages public input such as this during the §303(d) listing process.
p. 65. You refer to Ingham 2001. Please provide us with a copy of this analysis or data that are the basis of Ingham's "personal communication" here.	A copy of flow data sheets and photo will be available with landowner's permission.
pages 65-69. Please provide data on livestock presence/absence when all data used as a basis for this table were collected.	This observation was not a component of the monitoring plan (Ingham 2000) and was not documented.
pages 71 to 72. You have devoted 1 and a quarter pages to bacteria analyses. Table 19 reveals that you have collected one, and possibly two, of your 3 one-point-in-time bacteria samples for Battle Creek within the largest livestock exclosure in LSRD lands. This shows the supremely flawed and livestock industry favoring approach to wq standards that pervade this assessment/TMDL.	Comments noted.
Plus, you simply failed to make the effort to get samples in Shoofly Creek during an appropriate time of year- i.e when water was present.	Comments noted.
We have no sympathy for your claims of area remoteness in and inaccessibility that you use to explain away the gaping holes in data. Advance planning, concentrated effort and coordination with other agencies like BLM (who has had crews in the field on a regular basis in much of this area conducting various allotment assessments) could readily have yielded a comprehensive set of data for this analysis.	Comments noted.

p. 76- Is this a typo- do you mean Beaver Creek at the end of paragraph 3?	This will be changed to Beaver Creek.
p. 76. We believe you need to develop TMDLs for all of the tributary drainages that you cast aside such as Beaver Creek, Camel Creek, Dry Creek, the entire length of Nickel Creek, etc. How are you going to be able to control sediment and temperature impairment in mainstem drainages if you do not address impairment in the extensive array of tributaries?	The sediment TMDL takes into account total miles in all 2nd order or larger water bodies in the Deep Creek watershed, which includes Beaver Creek, Camel Creek and Nickel Creek. Dry Creek is in the Battle Creek watershed, which does not have sediment, listed as a pollutant of concern. Further biological evaluations need to occur to determine if sediment is impairing the existing uses in Dry Creek.
p. 77. We disagree with delisting of Shoofly Creek. You failed to collect necessary data on Shoofly Creek upstream of the Reservoir. Without that data, you can not delist the entire stream.	If data becomes available that indicates impairment of Shoofly Creek, DEQ will consider this information for future assessment and TMDLs, if necessary. DEQ encourages public input such as this during the §303(d) listing process.
p. 79. How can you possibly discuss a "Pollutant Source Inventory" and not discuss livestock congregating on and around high desert riparian areas in the Upper Owyhee - trampling and collapsing unvegetated streambanks, defecating in water, stripping vegetation necessary to protect banks from erosion runoff and filter out sediment??????	Rangeland is the primary land use in the Upper Owyhee. Sources of sediment were identified from streambank erosion, overland flow and internal loading. The removal of vegetation was also identified as having an affect on streambank stability and erosion.
p. 80. You rely on Dupont's 1999 claim in a Memorandum as a basis for the crazed and erroneous contention that "the current down-cutting if the streams in the North and Middle Fork Owyhee watersheds is probably not associated with current land use practices, but with the removal of beavers from the area" and claim "this is also true for those streams in the Upper Owyhee Watershed". Such gross misunderstanding of the role of current livestock grazing in stream downcutting shows the extreme bias of IDEQ towards protecting the interest of the livestock industry at all costs. For example, photo 15, page 88 shows a "nickpoint on Castle Creek". It is not the lack of beavers that is causing the nick point. It is the extreme grazing disturbance causing down-cutting and erosion throughout the watershed. We note that this, as most of the photos in the TMDL, was taken in a period when livestock appear to not be present.	The reference to Dupont 1999 only states that the degrading of hydrologic condition probably began with the removal of beavers in the early 1800's. The statement also explains that current land use practices in some areas will also contribute to degraded streambank conditions.
You need to consider the watershed-level impacts or declines in native herbaceous vegetation, and increases in exotic weedy species (shallow-rooted, poor watershed stabilizers) in all of these watersheds. Not only must there be vegetation on	Water body morphology and vegetation were discussed in Section 1.2 and 3.2 as well as the effects these current conditions may have on the vegetation. The effects the current vegetation may have on streambank stability was also discussed.

streambanks to filter sediment and slow erosion, but the uplands must heal and recover from current widespread livestock damage. Likewise, you need to discuss the watershed-level losses in microbiotic crusts caused by livestock trampling	How proper vegetation cover will induce better surface-ground water interface was also discussed. Upland conditions were not considered because of the overall lack of data on sediment delivery rates from uplands. Available data also indicates the uplands have a large quantity of land that is classified as low erosion potential.
p. 91 fails to mention the most effective potential management "tool"/action of all in bringing about satisfactory riparian condition, i.e, removal of livestock from the watershed.	Page 91 is located in Section 4.2, which discusses current practices to address non-point pollution sources in the Upper Owyhee Watershed. Management activity to achieve the goals of the TMDL will be developed in the Implementation Plan.
TMDL 93-110. Again here, without fully taking in to account livestock as the overwhelming causal agent in wq impairment here, we do not believe you can develop an adequate, or science-based, TMDL. You say that your model is based on "rangeland". What are the inputs and assumptions in this model that deal with livestock grazing?	There are many variables used in the model, but land use is not included.
You claim to calculate pollutant loads by source. How can you do this if you do not include tributary drainages in the TMDL? For example, you have failed to do an assessment of all of Nickel Creek, and some other tribs in the Deep Creek watershed. These drainages are all a source of sediment, bacteria, flow reduction (due to livestock-caused downcutting and loss of riparian habitats) and heat-loading input for the mainstem where you claim to do a TMDL. To address wq impairment on the mainstem, you have to fix the tributaries and headwaters.	Sediment load calculation took into account 2nd order streams or larger for the entire Deep Creek watershed. A streambank stability target will be applicable for all water bodies meeting the criteria. The temperature TMDL is applicable only to those segments listed and determined to exceed WQS. As stated in Section 5.2 upstream or headwater reductions will be required to achieve WQS for the month of June.
You also claim that a required part of loading analysis is quantification of current pollutants by source. Again, this is impossible to do unless you grapple with details of livestock abuse, in all trib. drainages/watersheds.	Source identification was based on the rangeland land use. Rangeland as defined in Webster's Ninth New Collegiate Dictionary as: land used or suitable for range. Range as defined in the same publication as: an open region over which animals (as livestock) may roam and feed.
You state that "a required part of the loading analysis is that the load capacity be based on critical conditions" -- the conditions when wqs are most likely to be violated. Again here, you need to grapple with the details of livestock grazing, and YOU NEED TO HAVE CONDUCTED YOUR ASSESSMENT AT TIMES AND IN AREAS WHERE LIVESTOCK ARE PRESENT. You have failed to do this -- as with collecting water samples for bacteria assessment inside an exclosure, or examining stream sediment or turbidity during periods when livestock may not be present. Anyone	The critical period is designed to address a critical period for the support of the existing or designated beneficial uses. Temperature during salmonid spawning and incubation periods was found to be the most critical period. This translated into the temperature criteria for the month of June. Sediment must be addressed on an annual basis. Surrogate measures such as improved bank stability and decreased percent fines will apply as yearly management targets.

who has spent a day on public lands in Owyhee County realizes the impacts of livestock moving in and around streams on increased water turbidity and soil/sediment (suspended and bedload) disturbance.	
We note that you rely on a discharge model by Hortness and Berenbrock - was this model developed for forested lands? How does it factor in grazing disturbance?	The model by Hortness and Berenbrock was developed to estimate discharge for eight regions within the state of Idaho. A forestry component is built into the model. The documentation for the model can be found at : http://idaho.usgs.gov/PDF/wri014093/ There is no component for rangeland land use. However, the shade components are similar and can be applied to appropriate elevations.
We believe there are 2 peaks in turbidity and sediment loading -- during spring runoff - you have collected no data then, and during the period when livestock are actively grazing a watershed/stream segment. You have not provided data that shows you have examined this, either.	Turbidity samples were collected in late summer on Juniper Basin Reservoir and Blue Creek Reservoir. A linkage to detrimental effects on aquatic life was used to establish a reasonable target. If data becomes available that indicates impairment of streams in the Upper Owyhee watershed, DEQ will consider this information for future assessment and TMDLs, if necessary. DEQ encourages public input such as this during the §303(d) listing process.
p. 102. You discuss load capacity targets of 50-80 and mg/l for sediment û are the load capacity targets to be attained during periods of maximum disturbance (runoff, cows present), or are they to be averaged over a year?	The 50 mg/l and 80 mg/l suspended sediment target are based on a monthly average and fourteen day averages, respectively.
Please provide us with a copy of the all the various models you used in TMDL development (Hortness, Seronko, Horsburgh, etc.). It is necessary to review these in order to understand the claims made in this TMDL.	The model by Hortness and Berenbrock can be found at : http://idaho.usgs.gov/PDF/wri014093/ The Modified Universal Soil Loss Equation can be found at: http://www.sedlab.olemiss.edu/rusle/registration.html The Stream Segment Temperature Model can be found at: http://www.mesc.usgs.gov/rsm/rsm download.htm#TEMP The monitoring mentioned in Horsburgh will be provided.
p. 102. If streambank erosion is the largest contributor to surface sediment loads, you need to consider all streambanks in the watershed û not just mainstems.	The sediment TMDL take into account total miles in all 2nd order or larger water bodies in the Deep Creek watershed, which includes Beaver Creek, Camel Creek and Nickel Creek.

You claim that streambank erosion rates between 7.8 to 27.2 tons/mile/year will provide adequate targets. Doesn't this erosion rate mean that streams will still be downcutting, losing their floodplains, etc.?	Streambank erosion targets are based on the allowable sediment loading to the water bodies. With suspended sediment target of 50 mg/l an overall sediment load is calculated based on information from the Hortness and Berenbrock model for estimating monthly stream flow. Once a load was calculated, the amount of streambank erosion allowed to achieve the in-stream target was determined.
Also -- we believe you MUST consider the impacts of overland and ephemeral drainage soil erosion throughout the watersheds during runoff periods. How much sediment do they contribute? It is our direct observation from looking at "pedestaled" exclosures in the Owyhee uplands that 6ö of soil has eroded away from relatively flat surface areas in the past 30-40 years. How would an erosion rate of 6ö of soil in flat upland areas every 40 years (estimate some water, some wind loss) translate into sediment loads in Upper Owyhee streams? How does this rate compare to p. 102 Table 33, which discusses "estimated overland erosion". What do these numbers mean? Are the table numbers ONLY for the watershed segments where streams were assessed in this current process? Thus they would not include steeper east face Juniper Mountain streams? Does the Seronko model use various levels of vegetation and microbiotic crust cover under various (or NO) grazing levels/intensities? This is essential to understand the time frame and canges needed to meet TMDL goals, and to run accurate models that predict real world outcomes.	Overland erosion rate was determined via the Owyhee Resource Management Plan (1999) and the Modified Universal Soil Loss Equation. The model does not estimate delivery rates to water bodies. If information is available to calculate delivery rates it will be examined to determine applicability to the SBA-TMDL.
You say average stream width-depth ratios in the Upper Owyhee watershed are at a ratio of 25:1. You then adjust this number to 12:1 for final analysis. Is this 12:1 ratio the end-goal of your TMDL? How will such large width-depth ratios (12:1) in many of these small streams translate into acceptable habitat for aquatic species?	The end goal of stream morphology is site potential.
p. 104. Please elaborate on "natural sources" of pollution. Domestic livestock are NOT natural components of the Owyhee ecosystem/watersheds. What is the "natural" pollution source without livestock? Under both historic and current conditions?	Pollution sources in the Upper Owyhee are from natural and non-point sources. Natural sources are sources that that are not human induced. There is a certain amount of heat input into any water body that can not be controlled and is not associated with a human induced situation. All water bodies in a lotic environment will cause a natural erosion process without human intervention.
p. 105. The statement that "enhancement of streambank vegetation will promote bank stability à morphology. This will increase ground water supply and the hyporheic flow conditions ...". Please	Please refer to Thomas et al 1998, Wrobilicky et al. 1996 and Poole and Berman for discussion on hyporheic flows and surface water conditions.

elaborate on these statements, and explain how this all works in greater detail.	
p. 107. You state the entire load allocation is assigned to the primary land use, rangeland. Again here, please elaborate on what is meant by "rangeland". Does it imply livestock grazing s an extractive use?	Source identification was based on the rangeland land use. Rangeland as defined in Webster's Ninth New Collegiate Dictionary is: land used or suitable for range. Range as defined in the same publication as: an open region over which animals (as livestock) may roam and feed.
p. 105 raises concerns about "drought". Drought is a natural condition û livestock grazing has exacerbated drought impacts. Earlier you said that calculations (as in load capacity) must be based on critical conditions. Drought is a natural "critical" condition, so it is entirely appropriate that you collected data during a drought period. Plus, the watershed degradation from livestock grazing during drought years leave watersheds stripped of vegetation necessary to slow down spring flows in even normal spring high water periods. A "worst case scenario" is drought followed by a high water spring runoff event.	Drought conditions were addressed and presented as a Margin of Safety to be considered in the temperature model validation.
Finally, you need to add the East Fork Owyhee River, into which these streams flow, to the 303d list. This stream has chocolate water during runoff, dense algal growths in slack water areas in summer, no longer has more than a handful of native rbt, etc.	If data becomes available that indicates impairment of streams in the Upper Owyhee watershed, DEQ will consider this information for future assessment and TMDLs, if necessary. DEQ encourages public input such as this during the §303(d) listing process.
This TMDL should calculate time frames for recovery, removing impairment, based on no grazing, limited grazing, removal of livestock from most damaged watersheds, etc scenarios. What will recovery time frames be under various levels of relief from livestock grazing? The public is simply not willing to wait your estimated 20-100 years for achievement of wq standards in these nationally significant public wild lands.	This type of information will in all likelihood be included in an implementation plan.
We have reviewed the BLM 1:100,000 Riddle land status map. This maps clearly shows that one-third of the surface area of Ross Lake is surrounded by BLM lands. You avoid doing any assessment or TMDL on Ross Lake by claiming it is on Duck Valley Indian Reservation lands. This must be corrected, and an assessment done, as a significant part of this playalike lake is surrounded and affected by public lands. These lands and intermittent drainages are significantly degraded by livestock grazing by Petan Ranches. In addition, we failed to include the following streams in the list that need to be assessed for all possible impairments	Ross Lake is a dry-lake bed as determined on USGS 7.5 Quad Maps and was not on the Idaho 1998 §303(d) List and was not evaluated for this SBA-TMDL process. If data becomes available that indicates impairment of streams in the Upper Owyhee watershed, DEQ will consider this information for future assessment and TMDLs, if necessary. DEQ encourages public input such as this during the §303(d) listing process.

as part of the TMDL assessment process: Dickshooter Creek, Shoofly Creek, Harris Creek, Blue Creek, Little Blue Creek, Payne Creek, Squaw Creek, Ross Slough, Red Basin Creek, Carter Creek, Long Meadow Creek, and need to be listed for all impairments on the next 303d list.	
Another major reason that you must conduct an assessment/TMDL on the East Fork Owyhee is the documented mine pollution problems/chemical leaching just upstream of Duck Valley at the Rio Tinto mine near Mountain City. These pollutants will be carried downstream into Idaho East Fork Owyhee waters.	If data becomes available that indicates impairment of streams in the Upper Owyhee watershed, DEQ will consider this information for future assessment and TMDLs, if necessary. DEQ encourages public input such as this during the §303(d) listing process.
Again, please also consider these as early comments on the upcoming 303d listing process.	If data becomes available that indicates impairment of streams in the Upper Owyhee watershed, DEQ will consider this information for future assessment and TMDLs, if necessary. DEQ encourages public input such as this during the §303(d) listing process.

Comments Received From: Robbin Finch, City of Boise Date Received: November 22, 2002	Response:
The draft TMDL is generally well written and documented. DEQ staff have done a very good job of collecting information and characterizing conditions in a geographically challenging area.	Comment noted.
2. Temperature Targets The draft TMDL proposes use of the cold water aquatic life and salmonid spawning water quality criteria for temperature (19C average/22C maximum and 9C average and 13C manimum, respectively) as applicable temperature criteria that are appropriate for maintenance of natural reproduction of Redband trout.	Comment noted.
The Columbia River redband trout Oncorhynchus mykiss gairdneri, a subspecies of rainbow trout Oncorhynchus mykiss, is native to the Fraser and Columbia River drainages east of the Cascade Mountains to barrier falls on the Pend Oreille, Spokane, Snake and Kootenai rivers (Allendorf et al. 1980; Behnke 1992). Redbands have adapted to the natural harsh water quality conditions, including high temperature, low dissolved oxygen and large variation in pH, common to interior and desert streams in Washington, Oregon, Idaho, Oregon and California.	It is agreed that the redband trout has adapted to the harsher environment associated with the arid areas of the Pacific Northwest, and many studies have demonstrated this survival record. Several streams in the Owyhee watershed are included in the Idaho Department of Fish and Game's Fisheries Management Plan as managed for wild stocks of redband trout (cold water aquatic life).
The temperature targets for the TMDL are lower than necessary and for many streams in the Upper Owyhee and other portions of the state attainable, due to natural conditions. Recent Idaho Fish and Game assessments in the Owyhee (Allen et al,1995) suggest that temperatures substantially greater than those proposed in the draft TMDL are more than adequate for redband survival.	Whether or not the cold water aquatic life temperature standard is attainable or not was not within the scope of this SBA-TMDL. This type of decision can only be made upon completion of a Use Attainability Analysis (UAA).
“Basic water quality parameters of water temperature, pH, conductivity, hardness and alkalinity were all within acceptable ranges for [redband] trout survival. Recording thermographs were placed in Jordan Creek from June until November, 1995. Maximum water temperature recorded was 24.6¦C on July 16, 1995.)	Other physical attributes were not evaluated since they were not listed as pollutants of concern. It is assumed these parameters are within Idaho WQS. Jordan Creek is located in HUC 17050108.
The final TMDL should: 1. Include additional information concerning the natural history, adaptation to the desert environment, and biological needs of redband trout;	The Upper Owyhee Watershed SBA-TMDL was developed with information provided by and collected by Idaho DEQ, other federal and state agencies, and any other information provided. The information requested in the comment was not provided by the fishery management agency or by

	the federal agency who oversees most of the land management in the Upper Owyhee Watershed. It was also not within the scope of the SBA-TMDL to include detailed information about the redband trout.
2. Select corresponding temperature and other (e.g. dissolved oxygen) water quality targets that are consistent with the natural conditions and needs of the redband species (e.g. seasonal cold water aquatic life temperature criteria or the natural background temperature narrative contained in state water quality standards).	Several streams in the watershed are included in the Idaho Department of Fish and Game's Fisheries Management Plan as managed for wild stocks of redband trout (cold water aquatic life). With this information in mind, as well as temperature data which showed violations of the WQS for temperature, such streams must be proposed for placement on the Idaho §303(d) list. If data exists which indicates that any of the streams we have proposed for the §303(d) list are in compliance with cold water aquatic life temperature standards, DEQ encourages public input with data to support this position during the §303(d) listing process. Whether or not the cold water aquatic life temperature standard is appropriate for these streams or not was not within the scope of this SBA-TMDL. Seasonal Cold Aquatic Life Use may be suitable for these streams, but this type of decision can only be made upon completion of a Use Attainability Analysis (UAA).

Comments Received From: Riddle Ranches Received via Fax: November 22, 2002	Response:
1) **Is the SBA-TMDL a draft or final document?** Your letter of October 21, 2002 indicates that the SBA-TMDL is a draft document. Such letter provided an Idaho Department of Environmental Quality (DEQ) web-address where the SBA-TMDL can be viewed. However, the October 2, 2002 SBA-TMDL document for the Upper Owyhee Watershed at the DEQ web-address states on its face that it is a Final Draft. The web-address document was reviewed for these comments, but ie was unclear if we were invited to comment to the SBTMDL in its entirety, or just invited to comment with regard to its proposed actions. Because the proposed actions stem directly from the SBA-TMDL findings and conclusions, we comment upon it in its entirety, including its findings, conclusions and proposed actions.	The document is a final draft. This implies that comments on the document will be reviewed with applicable comments addressed, changes made in the document, or further explanation made to clarify.
2) **Does turbidity in Blue Creek Reservoir exceed Idaho's WQS?** The SBA-TMDL claims that turbidity in Blue Creek Reservoir exceeded Idaho's WQS on page xviii of its Executive Summary and on ages 60 and 95 of it narrative. However, the SBA-TMDL does not report any actual measured turbidity values for Blue Creek Reservoir, or even summarize such measurements. It should provide at least a numeric summary of the turbidity data that was collected.	Tables have been added to the document in Section 2.4 to discuss in-reservoir turbidity data. The discussion on the exceedance of the turbidity criteria has been modified to address the narrative sediment criteria.
3) The Cold Water Aquatic WQS for turbidity is premised upon not exceeding background levels by either 50 NTUs instantaneously or 25 NTUs over a period of ten consecutive days (see SBA-TMDL pages 59 and 94, and October 2002 Idaho Administrative Code for DEQ at IDAPA 58.01.02.250.02.e). Thus, the Idaho Cold Water Aquatic WQS for turbidity must be evaluated in terms of how much it exceeds background levels. However, the SBA-TMDL does not determine, nor even discuss, background turbidity levels for Blue Creek Reservoir. No conclusion can be drawn regarding whether or not Blue Creek Reservoir exceeded Idaho WQS for turbidity until background turbidity levels are determined. See item 3) below for a discussion of background turbidity levels that are relevant to Blue Creek Reservoir.	The turbidity levels set in the TMDL are targets based on a linkage to detrimental effects on aquatic life. This reference to the water quality standards for turbidity will be omitted in the final submittal document. These standards relate to point source wastewater discharges. With this in mind, background concentrations are not applicable. The Idaho WQS for sediment prohibit sediment in quantities that impair the beneficial uses for the water body. An independent analysis of periphyton (Bahls 2001) showed severe impairment to the biological community in both Juniper Basin and Blue Creek Reservoirs.

4) Is the background turbidity for Blue Creek Reservoir 0 NTUs? The SBA-TMDL concludes that total turbidity load capacities for reservoirs are 25 NTUs over 10 consecutive days or 50 NTUs instantaneously on page 100. The SBA-TMDL lists the same Load Capacities for Blue Creek Reservoir in Table 31 on page 101, and the SBA-TMDL uses these total Load Capacities to calculate turbidity Load Allocations for Blue Creek Reservoir of 22.5 NTUs or 45 NTUs respectively on page 108-109.

The turbidity levels set in the TMDL are targets based on a linkage to detrimental effects on aquatic life. This reference to the water quality standards for turbidity will be omitted in the final submittal document. These standards relate to point source wastewater discharges. With this in mind, background concentrations are not applicable.

Capacities and Load Allocations are based upon the assumption that the background turbidity for Blue Creek Reservoir is 0 NTUs. However, the SBA-TMDL acknowledges on pages 105-106 that it was developed despite a lack of data and knowledge regarding existing sediment loads.

Table 39 shows the load capacity, or targets, for both Juniper Basin Reservoir and Blue Creek Reservoir. The reference to background levels located in Table 27 will be omitted in the final submitted SBA-TMDL.

Turbidity monitoring by Western Range Service (WRS) for Riddle demonstrates that the assumption of a 0 NTU background turbidity for Blue Creek Reservoir is invalid. WRS monitored turbidity levels along Blue Creek just above Blue Creek Reservoir from 1999 through 2002. A summary of such turbidity monitoring findings is presented in Table A below. (Table A is attached at the end of Riddle Ranches' Comments)

Data Table is located as last page of the Riddle Ranches comments. The data presented does not provide information on in-reservoir turbidity levels.

Several important points regarding turbidity levels for Blue Creek Reservoir can be illustrated by analyzing the date in Table A.

First, the background turbidity level in the late spring, prior to annual livestock use, varies somewhat from year to year, apparently in response to precipitation and associated stream flow on Blue Creek. Riddle observed that precipitation at the ranch was nearly normal in 1999 and 2000. The late spring background turbidity averaged 25 NTUs prior to livestock use in those years. In contrast, precipitation at the ranch (particularly winter snow) was noticeably below average in 2001 and 2002. The turbidity of Blue Creek averaged 16 NTUs in the late spring prior to livestock in these below-normal years.

The turbidity levels set in the TMDL are targets based on a linkage to detrimental effects on aquatic life. This reference to the water quality standards for turbidity will be omitted in the final submittal document. These standards relate to point source wastewater discharges. With this in mind, background concentrations are not applicable.

Second, it is reasonable to conclude that the measured late spring turbidity levels Represent the identified maximum background turbidity levels since the measurements were made before annual livestock grazing (the primary

See response above.

rangeland use) commenced.	
The SBA-TMDL bases its load allocations on land use, which it concludes consists entirely of rangeland in the Upper Owyhee Watershed (see SBA-TMDL pages 104 and 107). Thus, the late spring turbidity measurements made in near-normal years (1999 and 2000) are the best available determinants to establish the typical late spring background turbidity level for Blue Creek Reservoir, which averaged 25 NTUs.	See responses to pervious comment.
Second, it is reasonable to conclude that the measured late spring turbidity levels represent the identified maximum background turbidity levels since the measurements were made before annual livestock grazing (the primary rangeland use) commenced. The SBA-TMDL bases its load allocations on land use, which it concludes consists entirely of rangeland in the Upper Owyhee Watershed (see SBA-TMDL pages 104 and 107). Thus, the late spring turbidity measurements made in near-normal years (a999 and 2000) are the best available determinants to establish the typical late spring background turbidity level for Blue Creek Reservoir, which averaged 25 NTUs.	The turbidity levels set in the TMDL are targets based on a linkage to detrimental effects on aquatic life. This reference to the water quality standards for turbidity will be omitted in the final submittal document. These standards relate to point source wastewater discharges. With this in mind, background concentrations are not applicable.
Third, the background turbidity level of Blue Creek decreases through the summer, apparently as a result of diminishing stream flow. The fall turbidity measurements summarized in Table A were taken near the end if the annual livestock use period when the majority of the livestock have returned to private ranch lands. Therefore, these fall measurements represent the identified minimum background turbidity levels that existed after the summer grazing periods. The fall background turbidity level averaged 7 NTUs, significantly lower than the late spring background turbidity level. Assuming a relatively constant decrease in the stream flow and associated background turbidity level during the mid-point of the livestock use period averages 16NTUs.	The turbidity levels set in the TMDL are targets based on a linkage to detrimental effects on aquatic life. This reference to the water quality standards for turbidity will be omitted in the final submittal document. These standards relate to point source wastewater discharges. With this in mind, background concentrations are not applicable.
Fourth, the turbidity level of water that is being discharged from Blue Creek Reservoir was found to be significantly greater than the turbidity level of the water flowing into the reservoir. In early May 2000, the turbidity of water being discharged at the overflow outlet of Blue Creek Reservoir was measured at 46 NTUs, while the turbidity of Blue Creek immediately above the reservoir was measured at 16 NTUs the same day. The discussion of the "sediment problem" for reservoirs in the SBA-TMDL seems to assume that any sediments	The turbidity levels set in the TMDL are targets based on a linkage to detrimental effects on aquatic life. This reference to the water quality standards for turbidity will be omitted in the final submittal document. These standards relate to point source wastewater discharges. With this in mind, background concentrations are not applicable.

that are in suspension and are measured as turbidity in the water flowing into a reservoir will settle out and contribute to the sediment load of the reservoir. The May 2000 observations revealed that the sediment load leaving the reservoir as turbidity was greater than the sediment load entering it.	
The total Load Capacity for turbidity proposed under the SBA-TMDL needs to be increased to account for background turbidity. For Blue Creek, background turbidity is about 25 NTUs in the late spring, 16 NTUs in mid summer, and 7 NTUs in the fall. Therefore, appropriate instantaneous Load Capacities are 75 NTUs in late spring, 66 NTUs in mid summer, and 57 NTUs in fall. Appropriate ten-consecutive-day Load Capacities are 50 NTUs in late spring, 41 NTUs in mid summer and 32 NTUs in fall. Subsequent Load Allocations for turbidity need to recalculated based upon the above Load Capacities.	The turbidity levels set in the TMDL are targets based on a linkage to detrimental effects on aquatic life. This reference to the water quality standards for turbidity will be omitted in the final submittal document. These standards relate to point source wastewater discharges. With this in mind, background concentrations are not applicable.
Furthermore, the Margin of Safety (MOS) used for sediment in the SBA-TMDL is primarily based upon two unknowns; existing loads and current streambank erosion rates (see SBA-TMDL page 105). The determination of background turbidity levels in the above analysis provides answers to the first unknown. Therefore, the MOS for the Load Allocations should be reduced by at least half when they are recalculated.	The turbidity levels set in the TMDL are targets based on a linkage to detrimental effects on aquatic life. This reference to the water quality standards for turbidity will be omitted in the final submittal document. These standards relate to point source wastewater discharges. With this in mind, background concentrations are not applicable.
Finally, the estimated bank erosion rates for Blue Creek shown in Table 34 (page 103 of the SBA-TMDL) are form 46 to 688 times greater than the target bank erosion rate shown in Table 32 (page 101). It is inconceivable to us that current or historic land uses could account for this magnitude of difference, particularly in light of the fact that ecological status of the associated watershed was found to be late-seral or better in both 1980 and 1997, meeting and going beyond BLM's Land Use Plan requirements for range condition and trend. The target erosion rates, or the estimated erosion rates, or both, are unrealistic and should be reevaluated.	The values represented in Table 34 are gross estimates based on a streambank study conducted in an adjacent watershed with similar characteristics. The TMDL clearly states as more information is collected by land management agencies these values will be adjusted to reflect any further findings.
5) **Should Battle Creek and Shoofly Creek be removed from Idaho's "303(d)" list for bacteria?** Riddle agrees with the SBA-TMDL findings that Battle Creek and Shoofly Creek fully support primary and secondary contact recreation as existing uses. Riddle also agrees with the SBA-TMDL proposed action to remove Battle Creek and Shoofly creek from Idaho's "303(d)" list.	Comments noted.

6) Should Battle Creek be added to the Idaho's "303(d)" list for temperature? The SBA-TMDL finds that Battle Creek should be added to Idaho's :3030(d)" list for temperature during the next listing cycle on pages xxiv and 48. Riddle does not agree that Battle Creek should be added to Idaho's "303(d)" list for temperature during the next listing cycle.

Comments noted and addressed below.

The SBA-TMDL estimates in Table 29 that the amount of shade required to achieve target Load Capacities for temperature is often near 100%. In fact, the June estimates for shade requirements are all 87% higher. Such high shade requirements are certainly not attainable along Battle Creek. The BLM evaluated many of the creeks within the Upper Owyhee Watershed for Wild and Scenic River eligibility. Such evaluations determined that the nature of canyon-bottom streams such as Battle Creek that are confined in deep, narrow canyons have limited potential to establish any additional streamside vegetation because of the intense streambank scouring that occurs each year during the high spring flows. Therefore, the degree of shading that the SBA-TMDL estimates is needed in order for Upper Owyhee creeks to achieve the temperature WQS for Cold Water Aquatics is not attainable along Battle Creek, and it should not be added to the "303(d)" list for temperature during the next listing cycle.

Battle Creek is included in the Idaho Department of Fish and Game's Fisheries Management Plan as managed for wild stocks of redband trout (cold water aquatic life). With this information in mind, as well as temperature data which showed violations of the WQS for temperature, Battle Creek must be proposed for placement on the Idaho §303(d) list.

If data exists which indicates that Battle Creek is in compliance with cold water aquatic life temperature standards, DEQ encourages public input with data to support this position during the §303(d) listing process.

Whether or not the cold water aquatic life temperature standard is attainable or not was not within the scope of this SBA-TMDL. This type of decision can only be made upon completion of a Use Attainability Analysis (UAA).

General Comments

Information presented in the SBA-TMDL indicates that many of the streams were found to be dry during at least some of the field monitoring conducted by the Idaho DEQ. Including portions of Shoofly Creek and Blue Creek above their reservoirs. Some of the other creeks discussed were found to be dry for a period of time every year that monitoring was conducted. It does not make any sense to require that these streams achieve temperature and turbidity WQS's for Cold Water Aquatic species when the fact that they are often dry is the most significant limiting factor for such species. Therefore, Cold Water Aquatics should not be considered a valid existing use for these creeks.

Intermittent Waters. A stream, reach, or water body which has a period of zero (0) flow for at least one (1) week during most years. Where flow records are available, a stream with a 7Q2 hydrologically-based flow of less than one-tenth (0.1) cfs is considered intermittent. Streams with natural perennial pools containing significant aquatic life uses are not intermittent(IDAPD §58.01.02.003.53). Since there are no historic flow data in the Upper Owyhee Watershed, streams were classified as intermittent based on USGS Topographic maps.

Numeric water quality standards only apply to intermittent waters during optimum flow periods sufficient to support the uses for which the water body is designated (IDAPD §58.01.02.070.06).

Table 29 of the SBA-TMDL estimates that the amount of shade required to achieve target Load

The target of 100% shade represents total shade targets. It is clearly stated in the TMDL that in

Capacities is often near 100%. In fact, the June estimates are all 87% or higher. Such high shade requirements are virtually unattainable anywhere within the Upper Owyhee and are certainly not attainable everywhere along the stream segments listed in the SBA-TMDL. Since the shade requirements to achieve current target temperatures are unattainable, the targets need to be changed so that they can be attained.	many of the water bodies 35% of the shade requirement will be associated with topographic shading. The vegetation shading component will then be required to produce the remainder 54-65% for the water bodies on Idaho's 1998 §303(d) list As with sediment load analysis, the shade component will have site potential characteristics built into the Implementation Plan. This will be re-written into section 5.4 to address the site potential aspect.
Riddle reserves the right to provide additional comments and input during the anticipated development of implementation and monitoring plans that will affect them (see SBA-TMDL pages xxviii and xxix). We wish to forecast for you that Blue Creek Reservoir is an irrigation reservoir.	Comments noted.

Table A. Blue Creek Turbidity Data
Collected by Western Range Service for Riddle Ranches, Inc.
1999 through 2002

Date Collected**	General Period***	Turbidity (NTU) W-10	At each study W-11	Location W-12	Average Turbidity (NTU)
6/20/1999	Late Spring	24	28	25	26
11/4/1999	Fall	10	9	12	10
6/24/2000	Late Spring	25	24	23	24
11/20/2000	Fall	4	5	4	4
6/11/2001	Late Spring	16	27	19	21
11/13/2001	Fall	9	No data	No data	9
6/10/2002	Late Spring	15	14	20	16
11/11/2002	Fall	10	2	4	5
5/28/2000	Blue Creek about ½ mile above the reservoir =				16
	Blue Creek Reservoir at overflow outlet =				46

     * All data collected along Blue Creek approximately 0.5 to 1.8 mile upstream from Blue Creek Reservoir

     ** The 1999, 2000, and 2002 data were collected by WRS using a Horiba U-10 . Water Quality Checker. The 2001 data are based upon water samples that were collected by WRS and sent Alchem Laboratories of Boise for analysis.

     *** The Late Spring period is prior to annual livestock use along Blue Creek. The Fall period is near the end of the annual livestock use along Blue Creek, when the majority of the livestock have returned to private ranch lands.

Comments From: United States Environmental Protection Agency, Region X Received via E-mail: November 22, 2002	Response:
The U.S. Environmental Protection Agency (EPA) has reviewed the draft Total Maximum Daily Load (TMDL) for the Upper Owyhee Subbasin. Overall, the TMDL is one of the best Idaho TMDLs that EPA has ever seen. EPA appreciated the explanations and pictures, the background information on the each of the water quality segments, and the reasoning behind linking water quality standards to allocations. IDEQ provided a very useful table in the Executive Summary, which listed the pollutant, whether a TMDL has been developed, recommended changes to the 303(d) list and a justification.	Comments noted.
In general we believe that it can be the basis for a final document provided that some concerns are adequately addressed. EPA's specific comments are listed below.	Comments noted.
Comment The Clean Water Act and implementing regulations require that a TMDL be established ***with consideration*** of seasonal variations. IDEQ did not explicitly include a section in the TMDL on seasonal variations for temperature or sediment although critical conditions are touched upon in the margin of safety and design condition sections. ***Recommendation*** Explain how seasonal variations were considered in the TMDL analysis, even if IDEQ decided against seasonal allocations. Seasonal variations and critical conditions can be explained together. In the section, please clarify why June to August is an appropriate seasonal allocation for temperature (e.g., only time that temperature is violated), and why the temperature varies so greatly. For the sediment TMDL, it would be helpful to include a brief explanation on seasonal variations in sediment delivery from rain-on-snow events and general precipitation runoff.	A more in-depth discussion of seasonable variation will be incorporated into Section 5.1.
Comment No explanation or reference is provided in the TMDL for the instream target of percent fines (< 6mm of 30% or less for the substrate of the Creeks). ***Recommendation*** Provide a reference or explanation on how the target of instream target of percent fines was selected.	The reference to the 30% or less for percent fines is in reference to the macroinvertebrate analysis (Relyea et al. 2000). Most species that were determined to be tolerant of sediment were found in water bodies of percent fines greater than 30%. Those determined to be more intolerant of sediment where found in substrate with percent fines less than

	30%. This will be addressed and clarified in greater detail in section 2.4 and again during discussion of sediment targets in Section 5.4.
Comments Not enough explanation on how the loading capacity for sediment targets was determined. **Recommendation** Provide additional detail on how loading capacity for sediment targets (listed on Tables 30-32) was determined.	Sediment load targets are based on water column TSS levels found in other TMDLs developed in the state of Idaho. Section 2.4 will address sediment impairment to beneficial uses in more detail along with a more comprehensive explanation in Section 5.4.
Comment Not enough information is provided in order to fully understand the modeling used to determine sediment loading for this TMDL. **Recommendation** Briefly explain how the Hortness and Berenbrock model is used to determine sediment loading and consider including additional information on the Hortness and Berenbroock (2001) discharge model in the appendix. Inputs and outputs from the discharge model would also be helpful, particularly for the flowrates calculated in determining sediment loading capacity.	DEQ recognizes that Appendix D did not contain all the information that was alluded to in the document posted on DEQ's Web Page. The final SBA-TMDL will have an in-depth discussion of the model along with spreadsheets showing input values for calculating year round flows. Appendix D will also be expanded to show input values for monthly sediment loading. Flow data calculated from the Hortness and Berenbrock model will be displayed on monthly bases, with monthly load calculations for those water bodies requiring a TMDL.
Comment The WQ criterion for turbidity includes "shall not exceed background turbidity" and it is not clear whether and how background turbidity has been determined or whether it is assumed to be 0. **Recommendation** Clarify how background turbidity is calculated in the turbidity target.	Juniper Basin and Blue Creek Reservoirs are remote bodies of water originally constructed to store irrigation water. Very little data exists which would allow an assessment of historic or current conditions. DEQ believes it is not possible to establish background concentrations in these watersheds, because there are no reference conditions with which to compare. DEQ believes that 25 NTU turbidity is a reasonable target in these cases that is based on a linkage to detrimental effects on aquatic life and approximates the suspended sediment target used in portions of the watershed.
Comment Why give temperature load allocations based on the month, since what happened in June 1997 could be completely different than June 2003? **Recommendation** Explain why temperature load allocations are based on months rather than using flow-based allocations. Since flow changes constantly, a flow-based temperature may be a more appropriate compliance point than comparing future June temperatures to the June temperature loading capacity in the TMDL.	It is agreed that water temperature and flow can vary from year to year. However, to set the surrogate target (shade) for varied flow will provide a moving target for management goals. Using the lowest flow calculated through the Hortness and Berenbrock (2001) model provides the critical end point for the lowest flows possible. Since the surrogate target is shade, establishing a target for critical low flows would also be protective during higher flows.

Comment p 103: The transition from sediment loading capacity (LC) determination back to details of temperature LC determination is confusing. *Recommendation* The TMDL document would be improved if IDEQ described the temperature loading capacity and then the sediment loading capacity.	Section 5 will be redesigned to provide for a more readable document.
Comment p 107: In Table 36 different temperature load allocations are given for each month. Since the load allocation is to be met by establishment of riparian vegetation, this should be the same through each of the months so it seems odd to see the allocation expressed this way. *Recommendation* The TMDL document would be improved if IDEQ presented the surrogate target of percent shade here and stated the most stringent requirement for each waterbody as a target.	The month of June water temperature requirements are more stringent due to the need to meet salmonid spawning requirements. The months of July and August are less stringent due to different numeric criteria for cold water aquatic life.
Comment p 107: In Table 36, different temperature load allocations are given only for June, July and August. This implies that the temperature TMDL may be a seasonal TMDL. *Recommendation* If the temperature TMDL is a seasonal TMDL covering only the summer months, then make this clear in the TMDL document. If not, then clearly explain why IDEQ has chosen not to make this a seasonal TMDL.	Table 29 will be repeated after Table 36 to reestablish the shade targets as a part of the total allocations of the TMDL. It will be clarified that load allocations are based on the critical and seasonal periods when water temperatures exceed WQS.
Comment p 105: The margin of safety (MOS) section for the temperature TMDL lists a number of conservative assumptions. The first, third, and fourth assumptions listed under MOS relate to future benefits not quantified in the modeling and yet anticipated to occur as a result of planned implementation activities. The fifth assumption is difficult to understand. Were drought conditions used in the model, so they were conservative assumptions representing extreme conditions? The seventh assumption discusses how data was collected for low flow conditions in drought years, stating that stream temperatures are likely to be higher than normal during these conditions. While this can be true, it is sometimes the case that water temperatures are lower in the summer months of drought years, because the water in the streams is	The assumptions stated in the MOS for temperature will be more clearly addressed with more adequate explanations. The sixth MOS explanation will state that it is addressing Deep and Castle Creek only. The fifth and seventh MOS will be incorporated into an overall discussion of drought conditions and how that may affect water temperatures used to verify the model predictions.

composed of a higher percent groundwater than surface water and the groundwater is cooler. Without more information about the area it is hard to make the determination as to which is true here, but this is not necessarily a conservative condition. It should not be stated as such unless there is evidence that the influence of groundwater during drought years is minimal.

Recommendation
For the third assumption, provide an explanation of how implementation is expected to lead to reestablishment of the flood plain access. For the fourth assumption, explicitly state that this assumption pertains only to Deep Creek and Castle Creek, which are covered under the sediment TMDL. Clarify the fifth assumption and for the seventh assumption, either delete this assumption or provide evidence that the influence of groundwater during drought years is minimal.

Comment
p 105-106: it appears but is not stated clearly in the text that the TMDL uses an explicit Margin of Safety of 10% of the loading capacity for the sediment TMDL.

The 10% MOS for sediment will be explained in more detail in 5.4.

Recommendation
If this is true, please clearly explain that the MOS is explicit and provide a rationale for selecting 10%.

Comment
EPA, IDEQ and Idaho Conservation League and Lands Council agreed in a settlement agreement in 2002 to include a summary of the implementation strategies as outlined in the settlement agreement. The Executive Summary briefly describes long, medium and short term general implementation goals in very general terms such as bank stabilizing vegetation, stream canopy density changes in bank condition and vegetation utilization. Otherwise the summary outlined in the settlement agreement is not included in the proposed TMDL.

Section 4 will have a section to address implementation strategy.

Recommendation
Include in the TMDL a summary of the implementation strategies, which will include expected time frame for meeting water quality standards (WQS), approaches to be used to meet load allocations, identification of federal, state and local governments and individual entities that will be involved in or responsible for implementing the TMDL, and a monitoring strategy to measure implementation activities and achievement of WQS. Include a brief summary of the strategy in the Executive Summary.

Concern
It is not clear the rationale IDEQ used to propose delisting Battle Creek and Shoofly Creek for bacteria based on data from a single day.

Recommendation
Explain why the data to delist these segments for bacteria is sufficient (by referencing Idaho's water quality standards for bacteria and Idaho's waterbody assessment guidance) or provide additional data or remove the proposal to delist these segments.

Battle Creek and Shoofly Creek were placed on the 1998 §303(d) list based on one time samples for Fecal coliform bacteria collected by the BLM in 1993. In 2000, Idaho DEQ adopted *E. coli* as the indicator for determining the support status for primary and secondary contact recreation. This assessment is based on protocols established in the Water Body Assessment Guidance (DEQ, 2002). The protocols for determining support status using *E. coli* is as follows:

If a sample exceeds the WQS (406 CFUs/100 ml) for a one event sample of, it is not considered a violation of WQS, but triggers a need for additional monitoring. A geometric mean of 5 samples over a thirty day period is then required. If the WQS (126 CFU/100 ml) is exceeded, then the water body would be classified as not full support of primary contact recreation.

Sample results for Battle and Shoofly Creeks were well below the standard for support of contact recreation. DEQ will continue to monitor in this area and will in all likelihood obtain additional bacteria samples in the future.

Concern
IDEQ states in the TMDL document on p. 4, "This document will not attempt to assess interstate or tribal water quality concerns. However, a sediment allocation for one segment will establish a sediment reduction from the state of Nevada."

Recommendation
Provide an explanation on the contradiction within the above statements.

IDEQ will not <u>assess</u> the water quality or beneficial use(s) status on tribal or other state's waters. A sediment allocation is given to streams flowing from Nevada. This will be clarified on page 4.

pp xiv & 5: Stream mileages are different from one table to another.

The miles or acres stated in Tables A and 5 will be addressed and modified as needed.

p xvii: Table B under Pole Creek, recommended changes to 1998(d) list should be delist sediment; under Nickel Creek add temperature, metals and organic enrichment under proposed future listing-pollutant of concern; under Deep Creek add dissolved oxygen (or nutrients) under proposed future listing-pollutant of concern (see p 75);

Table B will be modified to address these concerns.

Add Camel Creek, Beaver Creek, Dry Creek, and Camas Creek for unknown pollutants (or temperature for Camas Creek–this is not clear) under proposed future listing-pollutant of concern (p

The Table B will be modified to address these concerns.

75-6) . p 43: Table 7, none of the columns have been completed for Castle Creek.	The Table 7 will be modified to address these concerns. The original version in the PDF format posted on Idaho DEQ's Web Page did not read the different font size that were used under Castle Creek.
p 71: under applicable bacteria standards, state the current criterion for e-coli.	A table will be added in section 2.4 under applicable bacteria standards.
p 76: under Beaver Creek, revise reference from Camel Creek to Beaver Creek.	This will be modified.
p 94: Table 27: be more explicit on the selected target of stream bank erosion rates instead of just "as defined by load capacity" add between 7.8 and 27.2 tons/mile/year.	This will be explained in greater detail under Section 5.4 to more clearly describe the link between streambank erosion rates and the in-stream sediment loading.
p 95: Clarify what is meant by "the allocation for state WQS for turbidity, MOS, background, and reserve for future growth will be set." Is this in a revised TMDL after post-TMDL monitoring or has part of the load allocation be set aside for future growth and background?	The last paragraph on page 95 will be modified in accordance with previous comments and responses concerning turbidity targets.
p 96: missing "and" in second paragraph between "Table 29....listed segments" and "...on those segments not on the 303(d) list."	This will be modified.
Pg 102: Second full paragraph, recent is misspelled. Appendix D; recommend adding a one to two page sample spreadsheet of data input and output for the SSTEMP model.	The misspelled words will be addressed. Appendix D will add an example of the SSTEMP model.

Comments From: Owyhee County Natural Resource Committee Received by United Sates Postal Service and E-Mailed; November 26, 2002	Response:
Comments: Owyhee County appreciates the effort undertaken by IDEQ in the preparation of the Draft and especially appreciates the honest attempt made by your office to inform and involve both the County Government and the citizens of the county in the development and modification of a document of such importance to the County. The following comments indicate general areas of concern, as well as a number of references to specific areas of the Draft where we disagree with either the approach taken, the resulting use of the data or the inference drawn from the resulting data.	Thank you for your comments.
The Upper Owyhee watershed is a semi-arid climate with heavy but brief precipitation events that negate many efforts at reducing energy loading in that the flashy nature of the streams make the establishment and maintenance of significant streamside vegetation very difficult or impossible. The average annual precipitation is 9 to 11 inches and average temperatures range from 80 to 85 degrees F. During June, July, and August temperatures regularly exceed 100 degrees F. The East Fork Owyhee Subbasin is below Wild Horse Reservoir and reflects the regulated flow of an unnatural stream. Wild Horse Reservoir provides irrigation water to the tribal lands and it is the runoff water from that irrigation that is the water flow in the Owyhee River. The tribal lands have not completed testing or assessment as of this date.	Thank you for your comments.
The County must emphatically point out that the data points or sources of data were extremely limited as admitted in the TMDL. Further, even with more data many of the streams do not and should not qualify for any actions under the TMDL. Further, even with more data on streams that actually qualify for various uses, the prediction model for temperature is fatally flawed and does not represent the real world.	40 CFR 130.2(g) states, " Load allocations are best estimates of the loading, which may range from reasonable accurate estimates to gross allotments, depending on the <u>availability of data and appropriate techniques</u> for predicting loading." If the commenter wishes to provide any data that would assist in determining the delivery rates from up-land erosion it maybe considered in an amendment to the Upper Owyhee Watershed SBA-TMDL. **Intermittent Waters** . A stream, reach, or water body which has a period of zero (0) flow for at least one (1) week during most years. Where flow records are available, a stream with a 7Q2 hydrologically-based flow of less than one-tenth (0.1) cfs is considered intermittent. Streams with natural perennial pools containing significant

aquatic life uses are not intermittent(IDAPD §58.01.02.003.53). Since there are no historic flow data in the Upper Owyhee Watershed, streams were classified as intermittent based on USGS Topographic maps.

The SSTEMP model has been used for a variety of TMDLs (Rio Chamita, New Mexico; Upper Ponil Creek, New Mexico; Navarro River, California). The Ponil Creek and Rio Chamita TMDLs were the templates and format for the Upper Owyhee Watershed TMDL. All TMDLs mentioned are approved, and thus DEQ believes the model use is an appropriate technique as described in 40 CFR 130.2(g). If the commenter wishes to provide any data that would clearly dispute the use of the SSTEMP model it may be considered in an amendment to the Upper Owyhee Watershed SBA-TMDL.

Considering the miles of stream from 1st to 5th order that are included in the TMDL, the data sources are wholly insignificant and cannot provide reliable indications or predictions of actual conditions on all of those stream miles identified in the TMDL. The TMDL admits that there were few sample sites, that more information is needed, and that sampling problems occurred when the sites dried up. (The Draft admits dried up sites on Pole Creek, Red Canyon, and Castle Creek. Nickel Creek was dry above the springs, and Shoofly Creek was dry above the reservoir. Juniper Basin Reservoir is always dry above the reservoir during summer months. Local ranchers who are very familiar with the area indicate that they have witnessed numerous segments of these streams that regularly dry up. Further, they indicate that even in wet years, the quantity of water in the creeks and river is minimal during the summer hot season.) Furthermore, most of the streams either directly or indirectly (e.g. tributaries) listed in the TMDL have not had adequate use attainability evaluations because many of the identified streams and associated tributaries are not perennial streams but rather are intermittent and/or ephemeral or do not sustain flows sufficient to attain WQS. The TMDL indicates that June temperature standards on the 303d listed streams will not be attained unless the standards are attained on the tributary systems. However, if those systems are intermittent and/or ephemeral they should not be considered in the process at all.

40 CFR 130.2(g) states, " Load allocations are best estimates of the loading, which may range from reasonable accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting loading." If the commenter wishes to provide any data that would assist in determining the delivery rates from up-land erosion it maybe considered in an amendment to the Upper Owyhee Watershed SBA-TMDL.

Use attainability analysis is not within the scope of the SBA-TMDL document. Existing uses were determined by the designation by Idaho Department of Fish and Game to manage certain water bodies for wild stock trout. With this management goal, the existing use was established to meet the goals of the management plan.

Intermittent Waters. A stream, reach, or water body which has a period of zero (0) flow for at least one (1) week during most years. Where flow records are available, a stream with a 7Q2 hydrologically-based flow of less than one-tenth (0.1) cfs is considered intermittent. Streams with natural perennial pools containing significant aquatic life uses are not intermittent (IDAPD §58.01.02.003.53). Since there are no historic flow data in the Upper Owyhee Watershed, streams were classified as intermittent based on USGS Topographic maps.
With this definition in mind, the intermittent water bodies must still be meet cold water aquatic life

	standards when sufficient water is available. It would not be expected that the target and allocation within in the TMDL be met when water is absent.
Additionally, even if the data sources were representative and streams were capable of attaining the WQS, the modeling used to determine the TMDL (reduction in inputs) necessary to meet the standards is clearly flawed. Table D-3 (page 188 to 208) show that of 40 stream segments evaluated, 24 would only meet the June standard with 100% shading and the remaining 16 would require 90% shading to meet the standard. Only two streams (Table 29, page 99) would meet the WQS for temperature with less than 90% total shading. While some segments in deep canyons would obtain nearly 35% of the total shading from topography, others with virtually no topographical shading would require 90 to 100% shading from vegetation. Recognizing that different stream types have varying capability for supporting shading vegetation, the conclusion that WQS can be reached through increased shading is obviously wrong. It simply cannot be done in the real world. Flat C type stream channels with fine substrate do not naturally support the woody species necessary to provide 100% shade. Likewise steep A type stream channels running through boulders do not support woody or herbaceous species capable of providing 100% shade. Examples of these situations are shown in Figures E 2, 7, and 10 of the TMDL. The statement on page 101 that the SSTEMP model has proven to provide adequate gross allotments is clearly not valid in the case of this TMDL. A statement in the Draft indicates the belief that if may take between 20 to 100 years to accomplish the results desired in the TMDL. Considering the issue of reducing stream temperature as stated above in this paragraph, Owyhee County would contend that the goals can never be accomplished due to the unique nature of the stream systems found here and the high summer temperatures that exist.	The SSTEMP model has been used a variety of TMDLs (Rio Chamita, New Mexico; Upper Ponil Creek, New Mexico; Navarro River, California). The Ponil Creek and Rio Chamita TMDLs were the templates and format for the Upper Owyhee Watershed TMDL. All TMDLs mentioned are approved, and thus DEQ believes the model use is an appropriate technique as described in 40 CFR 130.2(g). If the commenter wishes to provide any data that would clearly dispute the use of the SSTEMP model it may be considered in an amendment to the Upper Owyhee Watershed SBA-TMDL. The TMDL states that site potential for shade should be evaluated by the land management agencies and the model and the prediction for shading capability can be adjusted as more data is collected.
The <u>Sediment</u> discussion (pages 80 to 88) regarding upland contribution fails to acknowledge the alteration of sediment production associated with Western juniper invasion and conversion of uplands from sagebrush-steppe to juniper woodland. The change in vegetation significantly impacts watershed function in that the timing and volume of water produced is vastly altered. The change in vegetation changes the relative importance of the K Erodability Factor as well as the significance of slope. Juniper invasion increases the surface flow	If data can be provided showing the increased sediment from Juniper woodland areas it maybe considered for an amendment to the TMDL. If data is available to show the cause of the loss of understory and the resulting loss of fire frequency can be associated with some natural or un-natural source it may be considered in a modification to the SBA-TMDL. In May of 2000, a letter was submitted to the

during snowmelt and precipitation events and reduces infiltration, thus changing the timing and amount of watershed production during the year. The amount of water produced is also reduced due to the high water use potential of Western juniper. Clearly, the invasion of juniper over much of the area should be thoroughly evaluated and considered in the TMDL, particularly in relation to sediment production from uplands. Owyhee County does not accept the presumption, on page 29 of the Draft, that the current land use of livestock grazing is the cause of the juniper invasion. Juniper invasion has resulted from the removal of regular fire cycles from the landscape. Juniper invasion will continue to be a destructive force in the landscape until the juniper invasion problem is recognized for the damage it does to wildlife and water quality values and is dealt with in an effective way. Even the BLM has recognized the juniper issue in the Owyhee Resource Management Plan which plans for the removal, through burning, of a minimum of 7,500 and maximum of 15,000 acres annually for the twenty-year life of the plan. Juniper is invading into Red Canyon, and the upper reaches of Deep and Pole Creeks. The Draft has not adequately analyzed juniper's dominance in the plant community and the associated effects on water quality in the form of increased erosion, sedimentation and extraction of water from flows within the watershed.

| commenter requesting any and all data pertaining to the Upper Owyhee Watershed. At that time the commenter did not respond with data that would show the cause and affect of Juniper invasion on water quality. |

The TMDL indicates on page 102 that the modified universal soil loss equation was relied on to estimate watershed sediment yield from uplands. The TMDL should acknowledge that the MUSLE is not recognized as a valid and reliable indicator of potential soil loss from rangelands. The modifications of the USLE do not and cannot account for the variation found on rangelands within an entire watershed.

The use of the MUSLE was used as a tool to identify possible sources of sediment. The model or the results were not used in the final load allocations. If the commenter wishes to provide an appropriate technique that would assist in determining erosion rates and/or delivery rates from the Upper Owyhee Watershed, it may be considered for an amendment to the TMDL.

The discussion of allocation on page 104 indicates the TMDL will consider the forested land (this should be corrected to identify the woodlands and seral juniper woodlands not forested land) as part of the primary land use for rangeland. This approach completely disregards the true impact of invading juniper and should be changed. Seral juniper woodlands should be identified as a primary contributing factor in the changing of the timing and amount of both water and sediment production form uplands.

The reference to the Juniper woodlands identified as not fitting the overall description as forested lands was meant to show that this land use does not usually fit the general forest lands description where forest management is the principle source of pollutants. If data can be presented to discuss the possible sediment load associated with the invasion of Juniper it maybe considered for an amendment to the Upper Owyhee TMDL.

Page 18 of the Draft refers to the loss of beaver during the 1800's and page 32 makes reference to the watershed as having at one time supported a

The information compiled by Work (1830-31) that there may not have been many "signs" of beaver in the Upper Owyhee Watershed is not disputed.

viable population of beavers. It appears that the inference is that the region could, or should, once again support a significant beaver population. We question not only the validity of the statements but also the potential for reintroduction of any significant beaver population. The Draft cites presence of fine sediments forming fertile soils areas along stream corridors as proof of the presence of a previous viable beaver population. Historic records, however, contradict the presence of beaver in any significant numbers. From John Work's Field Journal 1830-1831 Expedition, edited by Francis D. Haines, Jr. comes the following information: "May 28, 1831 near Humboldt and Bruneau rivers, "During this days march the river is well wooded with poplar and willows yet there is very little appearance of beaver. Only 3 were taken today." In the 1820's, Hudson's Bay Company sent out expeditions to turn the Snake country into a "fur trappers wasteland", attempting to discourage further American encroachment of the Northwest. The first expedition was Peter Skene Ogden in 1824. John Work was commander of a brigade exploring the Portneuf River, Bruneau, Humboldt, and drainages of the "Sandwich Island" River (the Owyhee). The June 1, 1831 journal entry reflects: "…East fork of Sandwich island river. This little valley is about 20 miles long and 15 wide. A small fork falls in from the S, 2 from the E, and 1 from the W. all of which form one stream which runs N.W. through a narrow channel bounded by impassable rocks. The different forks in the valley have some willow on their banks and seem well adapted for beaver, yet the men complain that the marks of beaver are scarce." (Note, this site is now occupied by Wild Horse Reservoir.) As the expedition traveled westerly toward the south Fork Owyhee, they continually complained about the lack of beaver. The expedition traveled down the South Fork of the Owyeee, to the Snake. The only other wildlife were antelope. This was the first "European influence" in the Upper Owyhee drainage. Owyhee County doubts the trapping of beaver caused the deeply eroded stream channels as inferred in the Draft. It more likely occurred from natural causes prior to the arrival of the "European influence." Regarding the potential for reestablishment of viable beaver populations, in the photos within the Draft there are no visible food sources for beaver. Juniper is neither a food source nor a dam building material used by beaver. The Draft seems to indicate that Castle and Pole Creek have evidence of beaver but that current land use practices have been at fault in the removal of vegetation necessary for the reestablishment of beaver. The Draft also does not seem to have

However, the presence of European influences in southwest Idaho is documented in 1813 when Donald McKenzie first explored the area with the Pacific Fur Company. By 1818, McKenzie was operating fur trapping operations from the Boise River area to Bear Lake and the upper reaches of the Snake into what is now Yellowstone. Somewhere between 1819-20 three members of the McKenzie party had set out to explore the "Sandwich Island" Rivers, but never returned, assumed killed by local Native Americans. In 1826, Peter Ogden transversed the Owyhees and Burnt Rivers when they had a very successful trapping experience. Again in late summer of 1826 Thomas McKay set out to trap the Upper Owyhee Area with varying success. Peter Ogden also returned to the Snake River area in 1827 during the period when the Hudson Bay Company initiated the "scorched stream policy." This policy was to create wastelands so the Americans would not want it.

The statement that the rivers were well wooded with cottonwoods , willows and popular would indicate at the time that ground water near the stream was still available.

There is mention of the beavers and the hydrologic function their dams provided. It is well documented that the re-introduction of beavers in the Wood River Basin has increased water supply, reduced erosion and provided a inexpensive alternative to in-stream mechanical controls.

The beavers play an important role in the hydrology of a watershed. As water is dammed up behind structures, especially during high flows, water energy is dispersed onto the flood plain. As the energy decreases, fine sediment has the opportunity to deposit. Water is also percolated into surrounding soil. This water is re-released back into the water body and/or is used for woody plants along stream corridors.

The SBA-TMDL does not recommend management actions as this will have to occur on a site by site bases. However, it would be premature to discount the re-introduction of beaver into areas that could support this practice.

considered that reintroduced beaver populations would remove significant portions of the very vegetation that is proposed to be necessary for shading and energy reduction.

The Draft indicates that past and current land use altered vegetation of many of the riparian areas, cut down and incised stream beds and caused loss of access to historic flood plains. While livestock grazing may have contributed to riparian degradation prior to the passage of the Taylor Grazing Act of 1935 that has not been the case since the establishment of managed grazing systems and modern grazing management. Modern grazing management systems are not degrading streams. While taking a "historic" look at a landscape might seem to be useful or even necessary, we should always be aware that we cannot manage for what once existed since natural systems are always in a state of change. We can manage for some future condition, but we can't, and shouldn't try to, go backwards.

The Draft refers to the conversion of flood plain meadows to hay and pastures but fails to indicate how many acres of low gradient streams or old wet meadows are converted to non-native pasture or hay fields. Review of maps or aerial photos show very isolated irrigated areas and irrigation is not consistent throughout the watershed.

Regarding the reference to a steelhead fish remnant on page 30 of the Draft, the item is interesting, but hardly useful as evidence of the extent or quality of any historic fishery found within this subbasin. Without other documentation to show the evidence of a fishery, this remnant could easily be explained as having been brought to the area by humans rather than having arrived under its own power and via the tributaries of the watershed. Petroglyphs in the Owyhees, for example, have not shown fish. In addition to the possibility previously mentioned, there was a fish hatchery at Ontario, Oregon in approximately 1900, that released salmon and other fish into the tributaries of the mid-Snake, including the Owyhee. A number of other issues relating to fisheries exist within the Draft. The Draft states that, regarding Juniper Basin Reservoir, "no data found to determine if aquatic life is an existing use.", and also indicates that Kamloops trout were planted by Idaho Fish and Game in the private reservoir known as Blue Creek Reservoir. The draft indicates that Fish and Game have management plans for these two water bodies that give some credence to their consideration as fisheries subject to the water quality standards for salmonid

Comment Noted. The intent of the TMDL will not be to restore the area to pre-anthropogenic influence. The intent is to restore area streams to full support of beneficial uses and compliance with water quality standards.

Statistics for land use for each 5th Field HUC is located in Appendix B. These statistics show the amount of lands classified as irrigated.

It is well documented that both Steelhead Trout and Coho Salmon migrated into the Owyhee River drainage prior to the construction of dams on the Columbia, Snake and Owyhee Rivers.

Salmonid spawning was not recommended as a designated use for either Blue Creek Reservoir or Juniper Basin Reservoir. The Idaho Department of Fish and Game management plan only indicated that Blue Creek be managed for cold water aquatic life. Juniper Basin Reservoir has a TMDL developed to address cold water aquatic life until; a designation can be made that the existing use is another aquatic use besides cold water aquatic life. This designation can only be made through the legislative process by the state of Idaho, with approval by the US Environmental Protection Agency.

spawning. We question this approach, in particular since the species introduced in Blue Creek Reservoir does not spawn in the type of system into which they were introduced the population will only remain so long as Fish and Game continues to stock the water body. Regardless of temperature changes or whatever other water quality conditions are changed, these fish will never be self- supporting and should not be the basis upon which we are required to measure success in achieving the requirements of the Clean Water Act.

The Draft does not show flow measurements at monitoring sites. Flows must be greater than 5cfs for recreational uses and water supply, and equal to, or greater than 1 cfs for aquatic life uses.

Mean annual flow data was obtained through the use of discharge model data (Hortness and Berenbroock 2000) and was used to determine minimum flow levels. All water bodies except the small watershed of Nickel Creek exceeded the 1 cfs criterion for cold water aquatic life. However, the model indicated that the entire Nickel Creek watershed would exceed the 5 cfs criteria for the primary contact recreation flow criteria and the 1 cfs cold water aquatic criteria. The only other watershed that showed the that the 5 cfs criterion would not be met was Juniper Basin at an annual discharge at 1.96 cfs. It should be noted that Juniper Creek is not being recommended for primary contact recreation, but the reservoir itself will be. This will be clarified in Table 25 (old Table 23).

Concluding Comments: Allocations are gross estimates that IDEQ has made with the belief that, once more data is collected by appropriate land management agencies, refinements to the allocations can be made. While our experience with the Boise Regional Office of IDEQ has shown both the intent and willingness to take such appropriate follow-on action, that has not been our experience with other agencies. Even though we would expect The Boise Regional Office and IDEQ to honor its commitment for follow-on study and adjustment of the management practices, we must plan for what has become our most common experience in this vein. It has been our experience with the Bureau of Land Management that, once approved, plans are executed without regard to the economic havoc they create, without any real commitment to continued monitoring for the effectiveness of the management actions and without any subsequent modification. This experience leads us to take the position that the TMDL and subsequent Implementation Plan must be carefully reviewed and revised to ensure that the implementation behavior we have come to expect from the federal agencies is carefully fenced so as to do the least harm to the economy of the county and

Thank you for your comments. DEQ understands the balance needed to ensure a sound county economy and improved water quality. Past experience in this area has led DEQ to believe that implementation plans can be agreed upon and be workable documents. Additionally, DEQ will continue to provide a monitoring presence that will confirm the success or failure of management actions. In addition, DEQ welcomes appropriate data from sources outside designated management agencies.

to ensure that the efforts of all concerned are focused on pursuing those actions that have real benefit for the watershed and real potential for success. We believe that the issues raised in this comment paper, in conjunction with those presented during reviews of previous TMDL's and Implementation Plans where we have pointed to the attainment of beneficial uses, despite the presence of data indicating that water quality standards are not being met, should cause IDEQ to perform Use Attainability Analysis on the watersheds of southwestern Idaho. We believe that the evidence presented clearly shows that the standards for temperature on the streams within this area of Idaho have been incorrectly set. We maintain that the goals of this TMDL, and others, with respect to temperature reduction are not necessary in order to achieve the beneficial uses, are not achievable due to the natural background conditions, and will cause undue harm to the economy of Owyhee County. We believe that EPA's interpretation of the Clean Water Act has presented a problem to the western states that can only be resolved by addressing the fallacy of the current temperature standards. We also believe that, in light of the current regulatory environment, it is the only option IDEQ has available if its goal is to take those actions that will be of actual benefit in the watershed.	If data exists which indicates that any of the streams we have proposed for the §303(d) list are in compliance with cold water aquatic life temperature standards, DEQ encourages public input with data to support this position during the §303(d) listing process. Whether or not the cold water aquatic life temperature standard is appropriate for these streams or not was not within the scope of this SBA-TMDL. A less stringent WQS may be suitable for these streams, but this type of decision can only be made upon completion of a Use Attainability Analysis (UAA). While UAAs may be a future task for DEQ, the completion of SBAs and TMDLs in accordance with a court ordered schedule is DEQ's top priority. Thank you for your comment. DEQ will continue to work toward refining its understanding of the issues with the end goal of benefit to the watershed.

Comments from: Bruneau River Soil Conservation District	Response:
We feel that setting target loads for intermittent streams is not appropriate.	**Intermittent Waters** . A stream, reach, or water body which has a period of zero (0) flow for at least one (1) week during most years. Where flow records are available, a stream with a 7Q2 hydrologically-based flow of less than one-tenth (0.1) cfs is considered intermittent. Streams with natural perennial pools containing significant aquatic life uses are not intermittent (IDAPA §58.01.02.003.53). Since there are no historic flow data in the Upper Owyhee Watershed, streams were classified as intermittent based on USGS Topographic maps.
We request that DEQ accept information gathered within the year to make appropriate TMDL adjustments, de-listing portions, or all of Pole Creek, Deep Creek, Castle Creek, Battle Creek, Shoofly Creek, Red Canyon Creek, and Nickel Creek.	DEQ will continue to provide a monitoring presence that will confirm the success or failure of management actions. In addition, DEQ welcomes appropriate data from sources outside designated management agencies. If data exists which indicates that any of the streams we have proposed for the §303(d) list are in compliance with cold water aquatic life temperature standards, DEQ encourages public input with data to support this position during the §303(d) listing process.
We also feel that with limited to no data on Camas Creek, Camel Creek, Dry Creek and Beaver Creek, they should not be added to the 303(d) list.	The SBA proposes these streams for listing on the next 303(d) list based on appropriate data. Additional evaluation is needed in the future to determine whether a TMDL will be required.
Since Succor Creek is in another watershed, bank erosion estimates for Succor Creek should not be applied to streams in the Upper Owyhee watershed.	This is the only available data that would offer some comparison. The streambank erosion rates for Succor Creek were placed in the document only to demonstrate the variability of streambank erosion associated with the arid deserts in southwest Idaho. In the same section the document reads, "As more streambank information is collected by land management agencies the values in Table 34 will be adjusted." If there is other streambank erosion rates available and has a specific application to the Upper Owyhee Watershed, it may be considered for an amendment to the Upper Owyhee Watershed SBA-TMDL.
The District requests that DEQ properly evaluate these streams in 2003, in cooperation with partner agencies and watershed landowners.	DEQ will continue to provide a monitoring presence that will confirm the success or failure of management actions. In addition, DEQ welcomes appropriate data from sources outside designated management agencies.

Also shading and stream width targets should not be set by DEQ, but rather alternative prescriptive measures need to be established through the TMDL Implementation Plan.	Table 28 provides the mass/unit/tame requirement for a TMDL. The measurement of joules/meter^2/second is the link for the surrogate measurement of the required percent shade to achieve the State WQS.